MAY 1960 VOLUME 9 . NUMBER 5

Battelle Technical Review

IN THIS ISSUE : The Chemist in Research on Mental Diseases

VIGNETTE

ABBOTT A. PUTNAM

"Unreflective use of mathematics in the solution of problems can easily mislead us," states Abbott A. Putnam. "To solve a problem mathematically frequently calls for creation of a model—a complicated process that in itself might lead us from reality; then in the solution, one may be tempted to use familiar mathematical conventions rather than to seek the approach likely to give the best solution. It seems to me that often we would do better to picture to ourselves the dynamics of a process—by imagining ourselves, for example, a fluid in a stream or a flame in a combustor. We can then move more quickly from a simple problem to a simple conclusion. Such an approach has an additional advantage: it encourages changing our approaches to problems solving and keeps us from falling into habitual, and perhaps ineffective techniques."

Abbott's colleagues say that he delights in difficult problems, especially those appearing impossible to solve. He himself says that he has a liking for studies that enable him to make sense out of apparent scientific nonsense. His major fields of work provide opportunity for both types of problems—studies on: fluid dynamics as applied to pulsations in combustion systems, to recirculation, and to flame holding, spreading, and turbulence; applications of dimensional analysis; and heat transfer and material deposits in heat exchangers.

He has conducted research on combustion-driven oscillations in gas- and oil-fired units of different sizes and in rocket and ramjet models. He made major contributions to the discovery that there is an optimum shape for obstacles for flame holding that varies with the geometry of the combustor. Abbott and his colleagues were able to compute accurately the stray torques resulting from nonuniform heating of fluid in a small buoyant gyro system. Working with big industrial fans, they determined, for the first time, the significant factors in the design and use of three alternative industrial-fan-rating systems, assuring consistency in the rating of equipment.

In addition to his responsibilities with the aeronautics and thermodynamics division, Abbott is active in the work of several professional organizations. A registered engineer, he is a member of the American Society of Mechanical Engineers' Power Test Code and Aircraft Heat Transfer Committees. He is also a member of the American Rocket Society and the Combustion Institute.

Abbott received his B.S. degree in mechanical engineering from Cornell University. Prior to association with the Battelle staff he taught at Cornell, served as a design engineer with Dravo Construction Corporation, and investigated the fatigue life of aircraft structures with the then National Advisory Committee for Aeronautics. His writings over the period of his research activities have led to some 30 articles. He also edited the monograph *Injection and Combustion of Liquid Fuels* and was author of several chapters in the work.

At home, with his wife, Anne, and daughters Dianne and Mandy, he finds leisure in reading, model railroading, and yard work. Both Anne and Abbott devote much of their time to church activities.

BATTELLE TECHNICAL REVIEW

VOLUME 9 • NUMBER 5 • MAY, 1960

CONTENTS

Inside front cover — Abbott A. Putnam
Vignette

2 — The Chemist in Research on Mental Diseases
by FREDERICK BENINGTON

With the increasing interest in the biochemical factors in mental disease, the chemist takes on growing importance in mental disease research. The author explains the chemist's role and suggests how his studies may contribute to progress in the field.

9 — Hall and Magnetoresistance Effects and Their Applications
by R. KENT CROOKS

Long a laboratory curiosity, the Hall effect and magnetoresistance are now of interest in technological applications. Both present and potential uses of the phenomena are discussed.

15 — Notes from Battelle

Reports on research activities and developments of interest to science and industry.

18 — Writings by Staff Members

Papers and articles prepared by members of the Battelle staff that have appeared recently in books and periodicals.

261a — Battelle Technical Review Abstracts

Abstracts of articles and papers in a wide variety of technological fields from more than 1350 journals published throughout the world. Abstract selection largely reflects primary areas of Battelle research.

Dedicated to the dissemination of knowledge. Published monthly by Battelle Memorial Institute, an endowed foundation serving mankind through science and technology.

Please address all correspondence about articles, abstracts, subscriptions, and exchanges to: The Editor, Battelle Technical Review, Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio.
Accepted as controlled circulation publication at Columbus, Ohio.
Printed in U. S. A.

the Chemist in Research on Mental Diseases

by

FREDERICK BENINGTON

With the increasing interest in the biochemical factors in mental disease, the chemist takes on growing importance in mental disease research. The author explains the chemist's role and suggests how his studies may contribute to progress in the field.

Mental disorders may arise from a variety of causes; and those in the mental health field tell us that these causes are not too well understood. The inheritance of genetically-linked mental diseases has long been known, however, and the strong correlation between the stress of modern life and the incidence of mental disorders, particularly schizophrenia, is now fairly well accepted. More recently, medical science has reported the accumulation of evidence that certain biochemical changes can occur in both stress-connected and genetically-linked mental diseases.

In connection with the latter type of disease, interesting evidence has been gained by researchers from the experiences of identical twins living apart and, in some instances, unaware of the existence of each other. It has been found that if one of the twins becomes schizophrenic, there is a better than 95 per cent probability that the second will contract the same disease within a short time. It is as if each had a "built-in" alarm clock set to go off at a predetermined time, signalling the onset of the illness. Such evidence suggests that the biochemical factors have a highly important role in mental disorders. This is not to imply that mental disease is always of biochemical origin, and, therefore, may be cured by drug therapy alone. Certainly, psychiatry is the pre-eminent therapy for emotional difficulties that may trigger abnormal biochemical changes. Since chemistry is involved in such changes, the chemist obviously has a place

among those seeking causes of, and chemotherapeutic treatments for, mental disease.

The Chemist's Part in Mental Disease Studies

In research on mental-disease problems, the chemist will participate with psychiatrists, physiologists, neuropathologists, enzymologists, and scientists trained in other disciplines, depending upon the problem under study. Usually the team of researchers, generally under the direction of a doctor of medicine, is selected to cope with various facets of a broad program. Thus, a research director of a hospital may choose to study the incidence of abnormal steroid metabolism among schizophrenic patients. For such a study, he would probably require certain types of scientists: a number of M.D. clinicians to take data and case histories of patients; an enzymologist to study the patients' steroid metabolism; a neuropathologist to look for lesions within the nervous systems of patients who have died and, perhaps, show the connection of such lesions with abnormal steroid metabolism; and, finally, a chemist to devise good quantitative methods for determining the output of steroids in urine, blood, and spinal-fluid samples taken from the patients.

Usually the ultimate product of such a study is a report or series of published papers which might show, for example, that three-fifths of a moderate-sized schizophrenic population have a peculiar steroid metabolism. This useful piece of factual information does not solve immediately the problem of how to cure the schizophrenic patient. It does make available data that may be of use to other specialized research teams working on the schizophrenia problem. Such facts may be assembled eventually to give a clear picture of a certain mental disease in terms of body physiology and chemistry rather than on the basis of clinical symptomology. It can now be clearly seen that analytical chemists and biochemists are important in clinical studies of this type, since they devise the methods of measuring biochemical abnormalities and help in deciding what bodily metabolic pathways are at fault.

How the Brain Functions

To understand the function of the chemist in mental-disease research properly, it is necessary to be aware of the characteristics of the mammalian brain that make it different from other organs of the body. The anatomist, psychologist, and chemist have collected a great deal of information on this subject. Much as an individual in a community, the brain has abilities, rights, and privileges of its own. It is by no means autonomous; because it is composed of protoplasm, its is subject to many of the biological laws that govern the other organs of the body. At the same time, in many ways, the brain is unique in its anatomy and physiology. For example, it is wrapped in three membranes, which protect it from physical shock and injury. Each of these membranes is a definite anatomical structure which can be peeled away from the brain itself and seen with the naked eye.

A fourth, and perhaps unique protective feature of the brain, is an "invisible" wall which tends to isolate it from the rest of the body. Paul Ehrlich, in his monumental quest for a chemotherapeutic agent against syphilis, found that many dyes, when injected into the blood stream, colored the cells throughout the body without permeating the brain. Many later workers have observed and reported this unique "blood brain barrier" which excludes foreign and unnecessary molecules from the brain. Radioactive sodium chloride injected into the blood stream penetrates most of the body cells in about 10 minutes, whereas more than 60 hours are required for any measurable concentration of this material to enter the brain. The high monitoring efficiency of the blood brain barrier can be easily realized from the fact that about one pint of blood per minute is required to keep this delicate organ in operating order. Unlike many of the other organs, the brain cannot be deprived of its necessary food and oxygen for more than a few minutes without the occurrence of extensive damage. For example, severe brain damage has been known to result from a cardiac arrest (heart stoppage) of no more than 3 to 4 minutes.

Although the nature of the blood brain barrier is not well understood, it is believed that the brain cells

The study of new compounds has absorbed much of Fred Benington's time and interest. At present, for example, he is participating in studies relating to the synthesis of alkaloids and psychotomimetic compounds. Other research in medicinal chemistry and the investigation of problems in molecular distillation are currently engaging his attention, as well. Earlier, he conducted studies at Battelle on jet and rocket fuels and on the thermodynamics and kinetics of the evaporation of fuel droplets, work reported in the monograph, *Injections of Liquids Into Gases*. He has also participated in studies of the chemistry of phosphorous and nitrogen compounds for use in polymers.

receive their nourishment in an indirect manner via intermediate astrocytes. These star-shaped cells, which closely cover blood vessels in the brain, act as carriers between the blood stream and the nerve cells which require nourishment. Apart from this function, the close packing of the astrocytes over the surface of the blood vessels acts as a physical barrier to foreign substances that may affect adversely the function of the brain.

The main source of energy for brain cells is glucose which, in a manner of speaking, charges the batteries used to send the electrical nerve impulses and has no difficulty passing the barrier. Energy for the impulses is obtained in a 14-step chemical reaction utilizing oxygen and glucose. The excess thermal energy from this process is transferred away from the brain by the venous blood, which is actually about one degree Fahrenheit warmer than the arterial blood entering the brain. Within the brain, biological accelerators, called enzymes, are required to bring about this vital consumption of glucose. These highly specialized catalysts include hexokinase, zymohexase, and many other enzymes, which perform each of the highly specialized fourteen steps in the total degradation of glucose to water, energy, and carbon dioxide associated with most life processes. The selectivity of the blood brain barrier is clearly exemplified by the fact that many other sugars besides glucose, which are related structurally to it, are rejected as food for the brain cells.

We are now better able to see some of the possible biochemical factors that may accompany, or even be causative in certain mental disorders. These could include: (1) an insufficient or excessive oxygen supply to the brain; (2) leakage of toxic metabolites through the blood brain barrier; or possibly (3) errors in the basic enzymatic process within the brain itself.

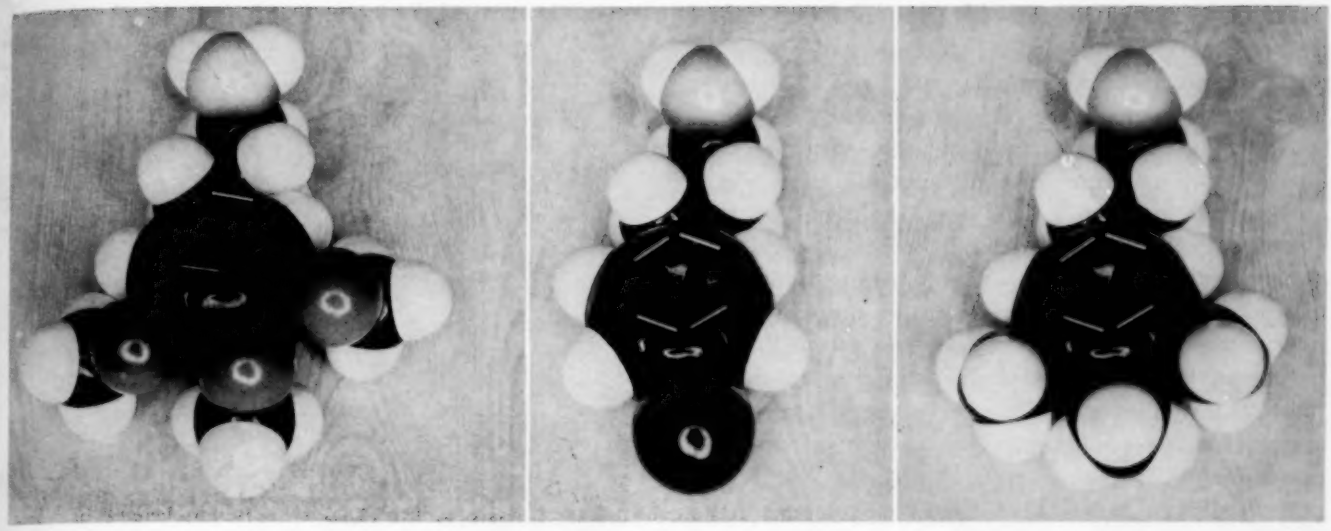
Though the efficiency and selectivity of the blood brain barrier as a filter has been emphasized, this is really a relative matter. It is well known that the barrier may "leak" and thus allow certain molecules to pass into the brain. These "leaked" materials may produce a wide spectrum of symptoms ranging from the subtle effects of mild traquillizers, such as meprobamate, to the well-known acute toxic effects of cyanides, carbon monoxide, and other substances which, in relatively small doses, lead to the ultimate death of the organism. Many of the chemically useful drugs that alter the mood and behavior of man are able to pass the blood brain barrier. These include the sedatives such as morphine, barbituates, and alcohol, as well as the excitants such as amphetamine, cocaine, and desoxyephederene; and many general anesthetics such as ether and nitrous oxide also enter the brain in this way. It is believed that most of these substances that can gain entry into the brain owe their effect, in part, to their ability to disturb the respiratory enzyme system within the brain. In moderate doses, most of these substances are clinically useful, since they do not produce irreversible damage to the brain before they are detoxified by the liver.

Man's Experiments With Drugs

Man's experimentation with drugs that alter mood and behavior probably began in the Stone Age and, according to Aldous Huxley, man became a potential drug addict before he knew how to cultivate drug plants for his own use. Thus, experimental psychopharmocology, the science of evaluating drugs, began as a crude science derived from self-experimentation. From earliest times it would seem that each society in turn discovered a drug which allowed its members to escape from the stress of everyday life. Among the many examples are opium in China, coca leaves in Peru and Equador, *rivea corymbosa* in ancient Mexico, fly agaric (a poisonous mushroom) in Siberia, and hashish in the Near Eastern cultures.

From the standpoint of mental-disease research, the most interesting class of naturally occurring materials are those that produce selectively visual, auditory, and tactile hallucinations without too much in the way of side effects. This interest arises from the fact that reactions to these drugs resemble, in some respects, certain schizophrenic symptoms. One of the best documented of these substances is peyote, a brew prepared from the buttons of the anhalonium cactus by our Southwestern Indians. Peyote has been used in the religious ceremonies of these people for centuries, and its use is controlled by the priest or medicine man of each tribe. The drug is revered by its users and seems to lead to no addiction. The user consumes the peyote brew in an evening religious gathering and is soon engrossed in a fantastic realm of indescribably beautiful color hallucinations and personal feelings which he deems a great religious experience. The next morning, after recovering from the intoxication, the subject may feel somewhat tired from the ordeal, but no untoward after effects are experienced.

Although this rite has been known to civilized man for many years, it was not until 1916 that the chemist explored the constitution of the alkaloids present in peyote. The hallucinogenic agent was found to be 3,4,5-trimethoxy-β-phenethylamine and is now called mescaline.



MESCALINE | 4-CHLORO-β-PHENETHYLAMINE | 3,4,5-TRIMETHYL-β-PHENETHYLAMINE

Structural models of three synthesized psycchotogens which produce certain symptoms of psychoses.

Until 1943, there were few pure compounds known that would act primarily as hallucinogens. Of course, it was known that overdoses of many common drugs, for example, atropine, will cause delirium hallucinations and fantastic dreams. The best hallucinogens up to that time were probably mescaline, harmaline, and the cannabis alkaloids. Some of the synthetics derived from cannabis, which were synthesized by Professor Roger Adams at the University of Illinois, are also hallucinogenic. This entire class of compounds is characterized not only by the production of sensory hallucinations, but also by the fact that the subject is in a fully-wakened state and is able to communicate with those around him. All of these agents must be given in fairly large doses to produce hallucinations.

In 1943 a significant and rather unusual discovery was made accidentally by the chemist Hoffmann, who was separating and characterizing the ergot alkaloids. While carrying out some identification on the hydrolysis products of an ergot alkaloid, Hoffmann began to feel confused and depersonalized and was unable to concentrate on his work. It was first thought Hoffmann was suffering from a severe mental upset because of the color hallucinations he was experiencing. The next morning, however, he had completely recovered. Being a careful investigator, Hoffmann wondered whether some of the materials with which he had been working were the cause of these unusual symptoms. He found that the last compound with which he had worked on the previous day was lysergic acid diethylamide (LSD-25), a derivative of one of the end groups of ergotoxin. In subsequent self-experimentation, Hoffmann demonstrated that this synthetic compound was a true hallucinogen in as small a dose as 0.000030 gram. This marked the discovery of a synthetic hallucinogen that acts in extremely small doses.

STUDIES AT BATTELLE

Study on hallucinogenic drugs began at Battelle only 7 or 8 years after Hoffmann's interesting discovery. Having just completed a new synthesis of mescaline, we had begun to wonder whether other compounds having chemical structures similar to mescaline might be expected to have this same type of activity. Dr. Richard D. Morin, and the author had initially thought that there would be little or no interest in this obscure field and that we might be able to work at a leisurely pace without the fear of being "scooped" on our publications. At this stage of our thinking we learned that Dr. Leland C. Clark, Jr., then head of the Biochemistry Department at the Fels Research Institute and now at the University of Alabama Medical School, had been very active in studying the biochemistry of mental disorders under a U. S. Public Health Service grant. He, too, was interested in the problem of whether certain structural analogs of mescaline would be hallucinogenic. After a long afternoon's discussion with Dr. Clark, we decided that the three of us would work in collaboration to investigate this interesting problem, Clark doing enzymology, animal studies, and psychopharmacology at Fels, and Morin and the author doing chemical syntheses and structure-activity correlations at Battelle. This conjoint effort has now gone on over a period of nearly nine fruitful years, and we hope it will continue for many more.

There are several reasons why we are interested in the relation between chemical structure and psychotogenic activity. The new word "psychotogenic" is being used here because these substances also cause personal feelings and behavioral changes that resemble a psychosis. First, knowledge of those structures which are psychotogenic may shed some light on the biochemical mechanisms of mental disease. The relation of chemical structures to psychotogenic activity may give some clue regarding the nature of those chemical intermediates in the body which are responsible for psychosis. Finally, a knowledge of the structures of these psychotogens could aid in the discovery of antagonists to counteract the naturally occurring psychotogens.

It should be noted here that psychotogens have found some application as diagnostic tools in clinical psychiatry. Many of the more adventurous psychiatrists have tried out the experience given by mescaline or LSD-25 in order to gain a deeper insight into their patients' psychotic feelings and disturbances. There are many psychiatrists who tell us that this experience is actually a form of "model psychosis", since these drugs produce a mental state which in some respects resembles the true psychotic state. There is some controversy concerning the clinical usefulness of these compounds as an adjunct to psychoanalytical therapy. However, we know of several clinical workers who are successfully using mescaline and LSD-25.

The matter of our synthesizing several hundred compounds representing a wide variety of β-phenethylamines having structural features related to mescaline and LSD-25 did not present the foremost barrier to our studies. In fact, we were able to interest the National Institute of Mental Health in our synthesis program. The primary difficulty was how to be certain that these new chemical compounds are psychotogenic materials. The level of toxicity of a compound must first be established in several species of lower animals. This level is usually determined and reported in milligrams per kilogram of animal body weight, and a lethal dose (LD_{50}) is that which produces death in 50 per cent of a given animal population. Though the LD_{50} values for a compound obtained on, say, mice, guinea pigs, and monkeys are known, it is still not safe to extrapolate relative sublethal doses of this compound for humans because of the species differences involved. However, the risk of producing untoward effects at a low dose level is usually small. Even if we know with certainty that our compounds have a relatively low toxicity, it is still a difficult matter to determine whether members of a group of compounds are psychotogenic in humans.

The effects of an injection of a psychotogenic compound are clearly perceptible in this cat. Pupil dilation, growling, hissing, aggression, and salivation are all suggested in the photo. After a few hours, the symptoms disappear.

Biochemical individuality, differences in mental outlook and conditioning, and many other subtle factors seem to determine what sort of a reaction an individual may have to a known psychotogen. This means that the design of complex statistical experiments using both drugs and placebos with groups of volunteers under the direction of a competent psychiatrist are required. This procedure is both expensive and time-consuming and is, therefore, reserved for the study of a very small number of compounds selected by means of other screening studies, which might be done on an initial group of several hundred compounds. We, therefore, turned to various animal experiments from which we can learn much before attempting to study new drug effects in humans.

Aside from toxicity measurements, various biochemical studies with our new potential psychotogens were made on the enzymes present in brain tissue

under carefully controlled conditions. By examining the effects of the new compounds and known psychotogens on the enzyme systems contained in a rat-brain homogenate, we attempted to find out whether the known psychotogens formed an activity pattern with various enzymes from which it would be possible to deduce the activity of new compounds. In this way we obtained a sort of enzymatic spectrum of some 37 compounds, which we thought might give a unique pattern with psychotogens.

Evaluation of Mescaline Analogs

The use of animals in the evaluation of materials requires unusual and highly developed techniques. For the purposes of such studies, the animal psychologist first carefully trains and conditions the subjects for the tests so that they will give a uniform and reproducible behavioral response to a given stimulus. Since animals cannot tell us how they feel, we can determine the effects of administered drugs only by studying the changes that may result in the previously conditioned response. From such experiments it is possible to tell whether a new compound might be a tranquillizer, for example, by studying its effects upon the conditioned response of the animal to a particular situation. One can never be absolutely certain that a compound is a tranquillizer, however, until it has been tried with human beings.

From the entire suite of compounds studied, we found that a series of 19 structurally-related mescaline analogs exerted strikingly similar effects on phosphatase activity and pyruvate utilization. In general, the ring-substituted methyl β-phenethylamines were found to inhibit phosphatase activity more than the methoxy compounds which are more closely related to mescaline. A somewhat surprising and perhaps interesting discovery was that the well-known tranquillizers—equanil, reserpine, and chloropromazine—all significantly increased phosphatase activity. However, bufotenine, a psychotogen occurring naturally in toad venom and in the cohaba hallucinating snuff used by the natives in Haiti, behaved toward phosphatase in much the same manner as the tranquillizers.

Although we were not successful in using enzymes to build active compounds, the general pattern of activity of various phenethylamines in these enzyme studies supported our earlier idea that enzyme study might be a useful tool for finding antagonists to mescaline and even perhaps to naturally occurring psychotogens. We therefore put aside the enzyme studies and began to make other investigations of these interesting compounds in different animal preparations.

Behavioral Studies. The approach which we used in studying animal behavior under the influence of mescaline analogs was that described by Drs. Norton and DeBeer of the Wellcome Research Laboratories. In their method, the gross behavior of normally adjusted cats is noted after injection of a new drug. They describe behavior in terms of pilomotor activity, pupil dilation, growling, hissing, withdrawal, aggression, and salivation. Probably the most striking discovery resulting from our behavioral studies was that in terms of this behavioral test, 3,4,5-trimethyl-β-phenethylamine called "desoxy mescaline" and a fair number of other new β-phenethylamines having substituents in the 3-, 4-, and 5-position of the benzene ring, produced a strong rage reaction in all the cats studied. In other words, these substances can change an ordinary household tabby cat into a fierce animal which you would probably be glad to see in a zoo.

The duration of these effects depends upon the dose and the chemical structure of the particular rage drug. Usually the rage reaction lasts but two or three hours and then the animal appears to recover completely with no residual effects or damage. It again becomes friendly, accepts food, and in all respects is a normal animal. No pathological damage from the drugs has been found in animals used in these studies.

In the course of many experiments with the group of 8 or 9 new rage compounds we have prepared, it was noted that the animals usually panted much like a dog on a hot day while recovering from drug action. Since cats do not usually pant, we deduced that the drug was causing an increase in body temperature. Indeed, it was found that at the same dose level, the drugs increased the rectal temperature of the animal in relation to their rage-causing potency. Thus, the 3,4,5-trimethyl compound produced a temperature rise of about 5 to 6 degrees F, whereas the less potent 4-methyl compound only caused a 2 to 3 degree rise. We also found that mescaline did not produce an appreciable temperature rise nor did it give what would be described as a rage reaction. On the other hand, the most potent psychotogenic material, Hoffmann's LSD-25, evoked a very strong rage reaction which appears to be like that produced by our rage compounds in all respects.

The excitation produced by these compounds can be almost completely eliminated by pretreating the animal with an intravenous dose of the well-known tranquillizer chloropromazine. Also, a cat pretreated with the tranquillizer reserpine, and then given the desoxy mescaline six hours later, gave a very low rage response. This procedure is used because reserpine is a slow-acting drug. Thus, the more potent

tranquillizers seem to obstruct the action of the new rage drugs.

The next question was, did the fever produced by the desoxy mescaline induce the rage reaction? Inducing fever in the cat by various other methods failed to produce any symptoms of rage. On the other hand, massive doses of drugs ordinarily used to reduce fever (aspirin, sodium salicylate, or antipyrene) had no measurable effect in lessening the fever accompanying the rage reaction. When our preparations were injected with iproniazid and the animal was then given desoxy mescaline, much lower doses of the latter compound were effective in causing intense rage. This is an interesting point because iproniazid is used to deplete amine oxydase, a brain and liver enzyme, necessary to catalyze the destruction of adrenalin.

We think that the action of the new rage compounds is somehow connected with the adrenalin or noradrenalin metabolism in a manner not clear to us at the present time. The fever-like action of these compounds suggests that the hypothalamus may be involved, since this is the site of body temperature regulation.

Study of Indoles

More recently our small group has turned to examining a psychopharmacological activity of a different class of compounds called indoles. These substances can be thought of as β-phenethylamines in which the side chain has been twisted around and attached to the benzene ring. Our interest in these substances arose out of several important discoveries of other workers. First, it was known that a solution of adrenalin is oxidized chemically under carefully-controlled conditions to a bright red substance called adrenochrome. Several years ago, a research group at the Saskatchewan Hospital found that this red indole compound is a psychotogenic substance when injected into human subjects. It was also realized that LSD-25 and bufotenine are indoles. Many workers began to wonder if there was any relation between the simple psychotogenic β-phenethylamines such as mescaline and the indoles which cause hallucinations at much lower dose levels. In the literature, investigators began to refer to an "indole mechanism" for the possible production of psychotogenic materials through a metabolic error in which adrenalin, noradrenalin, and perhaps the essential amino acid tryptophane would be converted to these active materials. By this time our group had begun to wonder whether mescaline also might be converted biochemically into an indole of high psychotogenic activity. After what amounted to an enormous amount of interesting work, we finally synthesized two new indole derivatives which had structures very close to mescaline. However, both proved to be disappointingly inactive when examined by the methods which I mentioned earlier.

This has not discouraged us from going ahead with the synthesis and study of these very interesting indole compounds; there are many possible avenues still left to examine. Many research teams throughout the world have become much interested in a rather mysterious indole compound called serotonin. This substance occurs in all mammalian blood platelets, in the gut, and in the brain. It also occurs in insect venoms and in plants as widely different as the stinging nettle and the banana. Although much is known about serotonin, no one is certain of its role in human biochemistry. Workers at the National Institutes of Health have shown that the normal level of serotonin in the brain is lowered by the action of several tranquillizers. Many have wondered if serotonin or one of its abnormal metabolites in the brain might conceivably cause certain mental disorders. Although this question has not been fully answered, many investigations are currently aimed at learning about serotonin's part in brain biochemistry.

Serotonin is related very closely to the psychotogen bufotenine; in fact, the only difference between these compounds is two methyl groups. I should like to mention that in our most recent work we have found that by attaching still a third methyl group on bufotenine, we have produced a very potent rage compound which we intend to investigate further. This substance does not act at all like bufotenine or serotonin. Since biochemical methylation occurs throughout the body, might it be possible for serotonin to be converted under abnormal conditions in the brain to a material like that we are currently examining?

The next decade could possibly bring important contributions to our knowledge about various aspects of the mental health problem. The 10 years just ended have already resulted in tremendous progress in the understanding and treatment of mental illness. Among the spectacular developments are the tranquillizers and the psychic energizer drugs which relieve certain depressed mental states. These materials alone have made it possible for large numbers of mental patients to leave the overcrowded mental hospitals and to lead useful lives once again. Also, drugs have proved useful in reactivating some catatonic patients so that it is becoming possible to apply psychotherapy to this group. If continued support is available in the coming decade for the deserving workers who can contribute to this field, it is certain that mental disease will become a smaller and much better understood problem.

Hall and Magnetoresistance Effects and Their Applications

Long a laboratory curiosity, the Hall effect and magnetoresistance are now of interest in technological applications. Both present and potential uses of the phenomena are discussed.

by R. Kent Crooks

The development of man's tools, in many instances, has followed a pattern that begins with the discovery of a physical phenomenon. Often, the effects produced are too slight to be of immediate commercial use. Through deliberate improvement in existing materials or development of new materials, however, the effect may be enhanced to the point where the phenomenon provides a useful tool for industry. The Hall effect is an example of this pattern of development. The phenomenon was first discovered by E. H. Hall in 1879, but it was not until the early 1950's that materials became available which exhibited the effect to a degree sufficient to create a real interest in its commercial application to a wide variety of useful devices.

Hall found that when a conductor carrying current, as shown in Figure 2, was placed in a magnetic field and oriented so that the flow of current is normal to the direction of the field, a potential appeared between contacts called Hall terminals on opposite sides of the conductor. The materials that were available for the conductor in Hall's day delivered a voltage at the Hall terminals which was too low to be of any practical use. With conductor materials available today, however, appreciable power can be extracted at the Hall terminals with reasonable values of magnetic fields.

Another phenomenon which is closely allied to the Hall effect is the magnetoresistance effect. Scientists have found that, with proper material and geometry, the resistance of the current carrying conductor can be made to increase several orders of magnitude with the application of a magnetic field.

The application of these effects offers considerable promise. Not only can devices be built that will amplify, control, or switch electrical signals, but numerous other functions are possible which are not easily accomplished with other semiconductor devices. A variety of devices have been built using these principles, and it requires little imagination to conceive of others which are yet to be developed and which may prove to be of great usefulness.

Basic Principles

The Hall Effect

The Hall potential is the result of a redistribution of charge carriers in a conductor that is brought about by the combined influence of an electric and magnetic field on the carriers. When electrons move in a conductor in a direction perpendicular to a magnetic field, they are initially deflected in a direction normal to the directions of both the initial electron velocity and the applied magnetic field. The force deflecting the electrons is directly proportional to the electron velocity and the magnetic field. This deflection process continues until sufficient charge has accumulated

at the sides of the conductor to establish a transverse electric field which opposes further deflection of charge carriers. The transverse potential difference thus created is called the Hall voltage, and the phenomena causing it, the Hall effect.

The Magnetoresistance Effect

If the Hall contacts in Figure 2 are short circuited and if they are so applied to the sample that they offer negligible impedance to flow of the deflected charge, then it is found that the resistance of the conductor to the exciting current will depend, over a limited range of field, upon the magnetic field intensity as

$$\frac{\Delta\rho}{\rho_0} \propto (\mu B)^2.$$

Here ρ_0 is the resistivity of the sample or Hall element material in the absence of a magnetic field, $\Delta\rho$ is the change in resistivity of the material, and μ is the charge carrier mobility. $\Delta\rho/\rho_0$ can be very large indeed in materials of high charge carrier mobility. In indium antimonide, for example, having a mobility of 70,000 cm^2cm/volt-sec, a value of 15 can be obtained for $\Delta\rho/\rho_0$ in a field of 10,000 gauss at room temperature. This is known as the Corbino magnetoresistance.

The effect may be considered to result because of the direction of the transverse current flow normal to the field B which leads to the establishment of a secondary electric field perpendicular to the directions of the original field, B, and the transverse current. This electric field opposes the flow of the exciting current, I, in the element and thus effectively increases the input resistance of the element. It is evident from the expression that the magnetoresistance effect can be increased greatly by use of an element material having a high carrier mobility.

Although the Hall element configuration shown in Figure 2 would exhibit the Corbino magnetoresistance effect if the Hall electrodes are short circuited, a more efficient element configuration is shown in Figure 1. In this arrangement, the exciting current contacts on each end of the element extend along its entire width. Since the ratio of the length to width (l/b) is small, the low resistance of the exciting current contacts effectively short circuits the Hall potential appearing across the width of the element. In practice l/b is made 1/3 to 1/4 in which case the magnetoresistance effect is about 95 per cent of the theoretical maximum.

As a consequence of the geometry of the rectangular magnetoresistance element, the zero magnetic field impedance of the device can be undesirably low. A means for increasing this impedance is, of course, to connect a number of such elements in series in a manner which would still permit insertion of the assembly in the magnetic field. Such a series assembly can be fabricated from a single slice of semiconductor of appropriate dimensions by applying a number of conducting bars to the surfaces of the slice parallel to the end contacts and at intervals which will provide individual semiconductor segments of the desired l/b ratio. The principal requirement of these conducting bars is that they be low in resistance so that the volume of semiconductor material which they cover is effectively short circuited. Electrodeposited gold is often used for the end contacts and bars.

Materials

A few typical examples of semiconductor materials which are applicable to Hall and to magnetoresistance devices are shown in the table. From the values of μ and p for the materials indicated, the Hall voltage of a given element can be predicted with considerable accuracy and is shown in the table. However, the magnetoresistance effect, although proportional to μ^2, is complicated by other factors related to the concentration of majority and minority carriers and carrier scattering mechanisms in the particular material used for the element. The value of $\Delta\rho/\rho_0$, therefore, is not easily specified without additional information on the particular element material. Relative values are shown for particular materials based on the μ^2 relationship and on the observed value of 15 for indium antimonide.

Interest in the electrical properties of materials and the application of those properties in industrially useful products has marked the research activities of R. Kent Crooks. At Battelle he has participated in the creation of electromechanical devices and systems operating at power-line to microwave frequencies and in the development of electromagnetic and telemetering equipment. His research has encompassed explorations of magnetic circuits, the use of semiconductors in control circuitry, railroad electrification problems, and industrial opportunities for electrical and electronic diversification. The author's earlier association with Union Switch and Signal Company led to studies of safety control and communications systems for railroads. While with the Gulf Research and Development Company he engaged in research on radio-guided ballistic bombs.

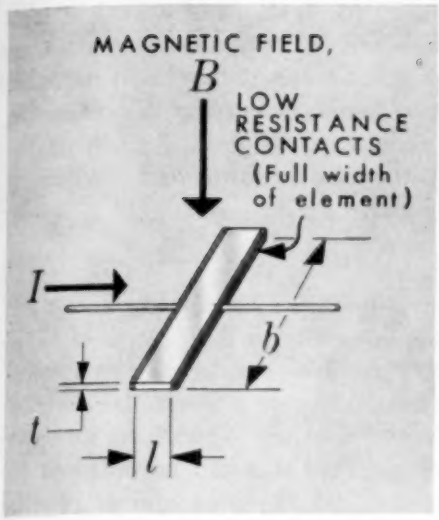


Figure 1

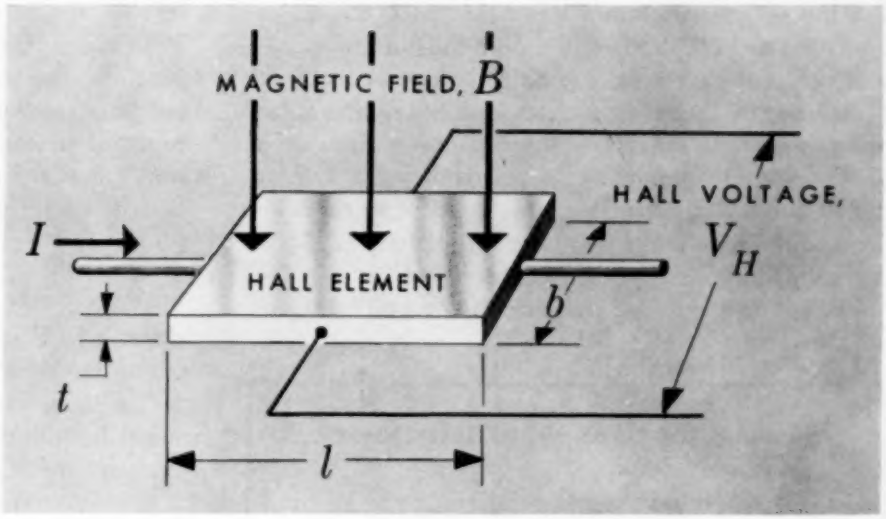


Figure 2

1. *Configurations of a single magnetoresistance element. The usual magnetoresistance unit comprises a series of such elements.* **2.** *Illustration of a Hall element showing the space relationship between the magnetic field (B), the element-exciting current (I), and the Hall voltage (V_H).*

As indicated by the expression for the Hall voltage, as shown in the box on page 12, a material chosen for use in a Hall voltage device should have a large product of $\mu\rho^{1/2}$. A material for use in a magnetoresistance device, however, should have a large μ. It is evident from the table on page 13 that the materials that have the highest μ have a relatively low resistivity, conversely the materials that have the highest resistivity have low μ. Of the materials shown in the table, silicon appears to be the best material for use in a Hall voltage device, whereas indium antimonide or indium arsenide appear to be better magnetoresistance materials. In a practical device, however, other considerations of a particular material such as temperature dependence and operating power level may modify these general conclusions somewhat.

Device Considerations

In the usual device using either of these effects, the semiconductor element is mounted in a gap in the core of the control magnetic circuit. Since practically all of the suitable element materials have nearly the same magnetic permeability as air, they act as an air gap in the magnetic circuit. Therefore, the element thickness is usually kept to a minimum to obtain as high a magnetic circuit efficiency as is possible.

Since both the Hall and the Corbino magnetoresistance effects increase with the magnetic field intensity, increased response results when the elements are operated at a relatively high field level. This is particularly true for magnetoresistance devices which are to be responsive to small changes in the magnetic field. In these instances the element may be operated at a large magnetic bias usually provided by a permanent magnet.

A distinct and important advantage, which devices operating on either the Hall or the magnetoresistance effects inherently have over other semiconductor devices, is the ability to isolate electrically the input or control circuit from the output circuit. This, of course, is achieved through the magnetic field which links the input and output circuits as in a transformer. This feature is especially attractive in d-c control and switching applications in which it is often advantageous to isolate the controlled circuit from the controlling circuit.

From an inspection of the values of ρ for the materials in the table, it is evident that the impedance of a Hall element may in general be quite high, whereas the impedance of a magnetoresistance element will be low. In a practical device, the impedance of a Hall element might be thousands of ohms and that of the magnetoresistance element a few ohms. This fact places a limitation on the load resistance into which the two devices operate, and it must be taken into account in applications to practical needs.

Thermal

As in all devices, practical considerations place an upper limit on the ultimate performance of the Hall

and the magnetoresistance effect devices. One major limitation in both devices is the permissible temperature rise of the element material. The carrier mobility decreases rapidly with an increase in the temperature of the material. Therefore, the d-c power dissipated in the element cannot be increased beyond a limit dictated by the thermal characteristics of the element and its mounting. A temperature rise of 25 C is permissible for most of the materials shown in the table without greatly lowering the mobility. Conversely, the mobility increases greatly at low temperatures and, therefore, for applications at low temperatures the performance can be improved over that indicated for room temperature. For this reason, a practical device should be designed to dissipate the heat generated in the element to prevent exceedingly high temperature rise.

Useful Expressions of the Hall Effect

The magnitude of the Hall voltage, V_H, in volts is given by

$$V_H = \frac{R_H I B}{t} \times 10^{-8} \text{ volts}$$

R_H = Hall coefficient, centimeters ^{3}/coulomb

I = element exciting current, amperes

B = magnetic induction, gauss

t = thickness of the Hall element, centimeters.

It can be shown that R_H, the Hall coefficient, is approximately equal to $\mu\rho$, where μ is the charge carrier mobility (velocity per unit electric field), cm^2/volt-sec and ρ the resistivity of the Hall element material, ohm-cm. The expression for the Hall voltage then reduces to

$$V_H = \sqrt{\frac{W\rho\, b}{l\, t}}\ \mu B \times 10^{-8} \text{ volts},$$

an expression which is valid for the weak magnetic field region, that is, as long as $10^{-8}\,\mu B << 1$. The other symbols are defined as follows:

W = the d-c power in watts, dissipated in the element by the exciting current, I.

b = the width of the element, cm.

l = the length of the element, cm.

From the last expression, it is apparent that the Hall voltage is proportional to $\sqrt{W}$ and to the magnetic field, B, impressed on the element and that for a large Hall voltage a material having a large product of $\mu\rho^{1/2}$ is desirable. It is also interesting to note that the Hall voltage is a function of the configuration or geometry of the Hall element. A value of 4 or more for l/b is necessary for the maximum theoretical Hall voltage.

Mechanical

Many of the high-mobility materials are brittle and difficult to handle, especially in the process of fabricating the device. For slicing and lapping techniques, a few thousandths of an inch is about the practical lower limit in element thickness. This places an upper limit on the Hall potential that can be obtained for a given material, since the output as indicated by the expression is inversely proportional to the thickness of the element. In addition to this, for most applications, the element is mounted in an air gap of the magnetic circuit and since the efficiency of the magnetic circuit is increased as the air gap is reduced, it is important that the thickness of the element be kept to a minimum within practical limits.

Electrical

The Hall and magnetoresistance effects described do not appear to diminish even up to frequencies of several hundred megacycles; however, the magnitude of the magnetic fields required to produce these effects is fundamentally difficult to obtain at the higher frequencies, and, therefore, both these effects are more applicable at d-c and low frequencies, of the order of kilocycles, at which the necessary fields are more readily obtained.

Applications

It is not difficult to imagine many applications of these two principles to useful devices. Numerous devices have already been conceived and built embodying these effects. A few examples in general classifications are described below.

The Hall Effect

Measurement of Magnetic Field. The most obvious applications of the Hall effect are for devices in which a voltage proportional to a magnetic field is desired. The measurement of magnetic fields in which the Hall voltage is used as a measure of the unknown field in the element is an example. Commercial instruments have been built for a number of years using this principle, originally using bismuth for the Hall element. Magnetometers have been built using Hall-effect de-

CHARACTERISTICS OF HALL AND MAGNETORSISTANCE MATERIALS AT ROOM TEMPERATURE

Element Material	Purity	R_H cm³/coulomb	μ cm²/volt-sec	ρ ohm-cm	V_H Hall Voltages, volts[1]	$\frac{\Delta\rho}{\rho_o}$ Relative Magnetoresistance Effect[2]
Bismuth		1.5	12,500	0.12×10^{-3}	0.07	0.5
Silicon	Medium	3.0×10^{5}	1,900	160	12.0	0.01
Germanium	Medium	8,000	4,000	2.0	2.8	0.05
Indium antimonide	Medium	62	37,800	1.64×10^{-3}	0.8	4.0
Indium antimonide	High	350	70,000	5×10^{-3}	2.5	15.0
Indium arsenide	Medium	10,000	40,000	250×10^{-3}	10.0	5.0
Galium arsenide	Medium	600	6,000	100×10^{-3}	1.0	0.1

1. W = 1 watt, B = 10,000 gauss, l/b = 4, t = 0.01 cm **2.** B = 10,000 gauss

tectors having a reported measurement sensitivity of 10^{-6} oersteds. Magnetic compasses operating on the principle have also been built which produce an output of 10^{-8} watts/degree deflection of the compass. Clip-on ammeters have been developed which will measure current flow in a conductor down to one milliampere on a-c or d-c without interrupting the conductor. These devices merely measure the magnetic field surrounding the current carrying conductor. Devices or transducers for the measurement of mechanical displacement are possible using the Hall effect. It is reported that sensitivity of one angstrom is possible with Hall elements operated in a magnetic field which has a 10 gauss/micron gradient. Such devices permit the measurement of mechanical movement of deflection without expending work from the prime mover or making physical contact with the member being measured. Rotational displacements have also been measured to a similar degree of sensitivity.

Amplifiers. Under the proper conditions, it is possible to amplify voltage, current, or power, with the Hall device. Since the magnetic field in which the element is located can be established with very little power loss, it is possible to obtain a gain in power at the Hall terminals over that impressed on the magnetic circuit. It is estimated that power gains of the order of 25 are possible under ideal conditions with this arrangement. One interesting application of the Hall amplifier is the amplification of direct currents. Since the amplification of d-c signals generally represents somewhat of a problem, the use of the Hall effect appears to offer considerable promise for amplifying small d-c currents. This is especially attractive since the noise level of such amplifiers is quite low.

Multipliers. From the expression of the Hall voltage, it is evident that the Hall voltage is proportional to the product of the element exciting current, I, and the magnetic field, B. The Hall effect, therefore, permits a voltage output proportional to the product of two variables and is used for numerous applications in which the product of two quantities is desired. One outstanding application of this is for multipliers used as a computer element in which the current I is made proportional to one independent variable and the magnetic field B proportional to another. The Hall output voltage then is proportional to the product of the two variables. This principle can be applied to many other situations; one of note is the measurement of the instantaneous torque delivered by an electric motor. If a Hall element is inserted in the armature winding of an electric motor so that it experiences the same current and the same magnetic field as a typical armature conductor, then the Hall voltage produced will be directly proportional to the force on the conductor. Thus, the instantaneous Hall voltage is proportional to the instantaneous torque of the motor and can be measured during actual operation of the motor.

The Magnetoresistance Effect

Many of the above-mentioned applications of the Hall effect may also be applications for the magnetoresistance effect. Since a considerable change in the

resistance of an element is possible through the application of a magnetic field, it is evident that power can be controlled through the use of the magnetoresistance effect. As pointed out earlier, the resistance of the magnetoresistance element is likely to be quite low and, therefore, such devices are more applicable for low-voltage and high-current devices.

The magnetoresistance effect is useful in applications in which a resistance change is desired without expending work from the prime mover or involving any sliding contacts. It is possible to change the resistance of a magnetoresistance element at room temperature by a factor of 60 or more by sliding the magnetoresistance element in or out of a strong magnetic field. Such a device has application as a variable resistance or potentiometer.

It is possible to obtain amplification using magnetoresistance effects. Amplifiers have been built which show a power gain of 25. It is estimated that this figure might be raised to 100 with optimum design. In addition, many similar functions, which are accomplished with vacuum tubes and transistors such as modulation, demodulation, phase discrimination, and voltage and current regulation, are also possible with magnetoresistance devices.

These examples are only a representative few of the possible applications of the Hall and the magnetoresistance effects.

Future Developments

Both of the effects described would be augmented if materials were available with higher carrier mobilities. At liquid-nitrogen temperature, materials with carrier mobilities an order of magnitude higher than those shown in the table are available and are interesting for future low-temperature applications of these effects.

As indicated, the Hall voltage is inversely proportional to the thickness of the element. It is obvious that if elements could be fabricated only microns thick, the Hall voltage would be increased considerably. Work is being done on the development of thin films of these high mobility materials. However, as yet, the mobility achieved by the thin film preparation has not begun to approach the mobility of the bulk material. When this is accomplished, we might expect a considerable increase in the usefulness of such devices. Such a development would make high frequency Hall amplifiers more attractive inasmuch as the high frequency magnetic field required could be developed more easily in a thin film than in the presently available thicker elements.

The Hall and magnetoresistance effects appear to offer considerable promise for devices yet to be developed and are certain to become very useful for numerous types of transducers and amplifying and control devices.

SCIENCE AS A CONCERN OF ETHICS

"The moment we ask what science is good for, we move into the broad area of ethics as morals. Science is concerned with the logics of existence, the verifiable knowledge about ourselves and our universe. What we use this knowledge for is a concern of ethics, of our value judgments, of our motivation, of our needs, and of our conduct in satisfying them.

"Actually the 'truth' about ourselves and our universe, as far as it may be agreed upon, has ethical significance. It fixes, certain limits about what is possible for us as individuals or as societies to do, whether we like it or not. Scientific principles, like gravity, act whether we like them or not, or whether we understand them or not. It is the part of wisdom to understand them."

Chauncey D. Leake, President,
American Association for the
Advancement of Science

NOTES from BATTELLE

STABILIZING POLYAMIDES

Polyamides, or nylons, are noted for exceptional toughness, outstanding mechanical properties, and unusual resistance to abrasion. Because of these excellent properties, the materials would make excellent jackets for wire and cable, except for their deterioration when exposed to light and to elevated temperatures for prolonged periods. In studies for the Signal Corps, technologists have sought to overcome these shortcomings.

Efforts to improve the heat properties of polyamides by the addition of stabilizing compounds have thus far been only partially successful, say Michael M. Epstein and Charles W. Hamilton. Studies have shown that the heat stability of materials such as nylon 66/610/6 is considerably improved by ordinary antioxidants. Polyamides containing piperazine as an amide forming constituent, however, are improved to a lesser extent for reasons not clearly understood, but apparently because of crystallization.

Epstein and Hamilton conclude that, at present, there seem to be no additives or combinations of them which can completely stabilize polyamides against heat aging. Moreover, it appears, on the basis of information now available, there is unlikely to be a generalized solution to the problem. Each polymer probably requires a careful experimental program to determine how it may be stabilized against deterioration.

AS-CAST ALLOY STRENGTH

Heat treatment and hot working normally increase the high-temperature properties of metals. Why, then, are the properties of as-cast high-temperature alloys frequently superior to those of heat-treated and hot-worked alloys? Metallurgists theorized that an optimum degree of heterogeneity existed for the solid-solution matrix which would yield the best high-temperature properties. This theory was tested in an investigation, conducted for the Aeronautical Research Laboratory, Wright Air Development Division, by H. J. Hucek and A. R. Elsea.

The alloys used for the study were prepared by compacting mixtures of copper and nickel—these elements being completely soluble in the solid state across the entire alloy system. Also, data from previous work on sintering copper-nickel powders was available for the study. Heterogeneity was varied by modifying the duration of the homogenizing anneal, the particle sizes of the metals, and the composition of the alloy. The effects of these modifications upon the high-temperature properties of the resulting solid-solution alloys were evaluated in terms of stress rupture.

Hucek and Elsea state that the following conclusions were drawn from the study:

- When the homogeneity of the alloys was increased significantly, their rupture life at 750 F was enhanced, but their room-temperature tensile properties diminished.
- Evaluation at 750 F, each composition having the same degree of homogeneity, showed that a 50 per cent copper—50 per cent nickel alloy was stronger than a 70 per cent copper—30 per cent nickel alloy.
- Increasing the grain size and density of the homogeneous solid-solution alloys, by lengthening the sintering time, led to longer rupture life at 750 F.
- The metallurgists concluded that greater heterogeneity of the solid-solution matrix is not the reason for the unusually long rupture life—as compared with more homogeneous wrought or heat-treated alloys—possessed by certain as-cast, high-temperature alloys.

MOBILE GAS-COOLED REACTOR

More than four years of materials research at Battelle have contributed to the successful development of the U. S. Atomic Energy Commission's First Gas-Cooled Reactor Experiment at the National Reactor Testing Station. The A.E.C. announced recently that the experimental reactor, representing the initial phase in a program to develop a mobile nuclear power plant for the Army, had achieved criticality. Battelle, which was the materials development contractor to the A.E.C., has worked closely with Aerojet-General Corporation, builder of the experimental reactor. It conducted critical experiments and formulated exact specifications for design of the fuel elements and core configurations. Corrosion studies at

Battelle determined the materials and environmental conditions under which nitrogen could be utilized as the reactor coolant. The Institute's initial critical experiments provided data necessary in finalizing the reactor design. Studies of radiation effects on materials have been a continuing part of Battelle's work on the project.

The water-moderated and nitrogen-cooled reactor experiment will generate 2,200 kilowatts of heat but no electricity, according to an A.E.C. announcement. It is being operated to test the first U. S. direct- and closed-cycle, gas-cooled reactor system. In such a system, gas heated in the reactor core is used to drive the turbine and then is returned to the core.

Start-up of the Gas-Cooled Reactor Experiment, said the A.E.C., is a major step toward development of a prototype power plant to be known as the Mobile Low-Power Nuclear Power Plant No. 1. It will combine the direct- and closed-cycle, gas-cooled reactor system with a gas-turbine power conversion system being developed by the Corps of Engineers at Fort Belvoir. The prototype reactor, scheduled for completion in early 1961, will generate about 400 kilowatts of electricity and operate at least one year at full power before refueling.

The entire power plant will be transportable in four packages totaling less than 38 tons. Either standard Air Force cargo aircraft or standard Army low-bed trailers could be used to transport the packages. The reactor plant could be put in operation 12 hours after delivery at a site.

ABLATION STUDY

Objects entering a planetary atmosphere are subject to intense heating from dissipation of the object's potential and kinetic energy. The extent of the heating depends upon the object's initial entry velocity, its weight-to-drag ratio, the nature of the atmosphere, and the gravitational attraction of the planet.

Vehicles designed for atmospheric entry usually have blunted leading edges so that much of the vehicles' energy will be dissipated by heating the gas behind a detached shock wave. Energy in the hot gas, however, is often sufficient to vaporize most materials. Some method must be devised, therefore, to give thermal protection adequate to get the vehicle and its passengers safely through the atmosphere. Experience with ballistic missiles has shown that materials which ablate—that is, gradually melt away—provide practical and reliable thermal protection.

The presence of particles, both solid and liquid, in planetary atmospheres complicates the problem of thermal protection because they increase the rate of ablation. To gain some understanding of the physical phenomena associated with the impact of high-velocity particles on an ablating body, a study has been conducted for the Army Ballistic Missile Agency. Edward W. Ungar states that in the research, glass-reenforced plastic specimens were exposed to the high-temperature, high-velocity gases in a rocket exhaust jet. Glass and alumina particles were accelerated by the jet and directed onto the specimens in order to simulate the impaction of naturally occurring and solid particles on the melt layer.

In the study, the melt layer was assumed to protect the underlying solid body by decelerating the particles. It was assumed, also, that in particle impacts, the energy transferred to the melt layer increases the layer's decomposition rate. The extent of the melt layer's protection was found to be dependent upon its thickness and the size of the particle impacting upon it.

No doubt about the topic being discussed here. It's Alaska. Pictured with Dr. B. D. Thomas, Battelle president, during their recent visit in Columbus, are Frank Heintzleman (center), former territorial governor of Alaska and advisor to the Alaska International Rail and Highway Commission and Dr. George Rogers (right), a consultant to Battelle on a study for the Commission. Their visit was in connection with Battelle's current resources economics and transportation study for the Commission, which will determine the location, extent, and availability of known and undeveloped resources which need additional or improved transport facilities for their commercial development.

After a theoretical study of the effects of impaction, which was checked against the experimental determinations obtained with the use of the rocket exhaust jet, the investigators developed an equation that expresses the extent of the melt layer's protection. The equation helps establish foundations for further research as new data about atmospheres become available.

* TUNGSTEN'S PROMISE

In the past, much of the knowledge of tungsten has been associated with the production of lamp filaments and narrow strip. But today, because of the strong interest in the high-melting metals, technical advances in tungsten metallurgy are likely to proceed at a much higher rate than heretofore.

In what areas can growth be expected for this metal in the years immediately ahead? Bruce W. Gonser and Vincent D. Barth have summarized its potentialities in the various areas in which tungsten is likely to be of interest in U. S. technology. Some of their conclusions are presented below.

High-Temperature Nonferrous Alloys. Use of these steels, containing to 15 per cent tungsten, will be continued at about the present rate. The only increase expected is that resulting from industrial growth.

High Speed Steels. Historically these have been built around an 18 tungsten - 4 chromium - 1 vanadium composition. Now molybdenum is replacing tungsten because of the former's lower cost and easier processing. Little increase in demand for tungsten can be expected in this field.

Hot Work and Other Tool Steels. Increasing demand for alloys with service ceiling up to 2500 F, and even higher, is resulting in the use of higher tungsten additions to cobalt-base alloys and further development of tungsten-base alloys. Some potentially important tungsten-rich alloys contain 2 to 10 per cent alloying additions. The molybdenum-tungsten alloying system is currently of great interest and will encourage greatly increased use of tungsten. Development of dispersion-hardened alloys as well as other tungsten-rich alloys will call for more of the metal. Gonser and Barth believe that use of tungsten in these alloys will increase several times the present rate in the next five years.

Wire, Rod, and Sheet. The U. S. Government is strongly interested in wide tungsten sheet for high-temperature structural applications. If present interest and technical success continues, this type of usage may at least double in the next five years.

Forging Billets. Since it is now possible to forge tungsten shapes, some growth in use of the metal in this area is expected.

Promising developments in slip casting of tungsten powders, vapor-phase plating, and arc-spraying of the metal may be of moderate importance in increasing the use of tungsten. At the same time, no great increases are expected in the following uses of the metal: gamma-ray shielding; cemented or sintered carbides; cast tungsten carbides; and tungsten chemicals.

In conclusion, the metallurgists point out that the current strong interest in, and the intense research being done on high-melting metals make it appear that technical advances in this field will proceed at an unusually high rate. Work to obtain wide sheet, castings, use as an alloy base, and use as a major alloying addition to other refractory metals is opening new fields of application that were not possible in the past. All of these developments should lead to a major acceleration in the use of the metal in the years ahead.

* "The nation's minerals industry needs some of the pioneering zeal of the miners in the early days of the West . . . We need a perspective that sees not only the very real troubles of the minerals industry, but also the opportunities for a brighter future," David C. Minton, Battelle vice president, stated recently before a convocation at the University of Arizona School of Mines. Acknowledging past achievements of the industry and its present capabilities, he suggested that, "A renewed spirit of optimism within the industry itself is more important than 'more help from Washington' or any other external force." Minton was on the Tucson campus to receive a Medallion of Merit, bestowed upon alumni by the University in recognition of their accomplishments.

* Battelle staff members recently named to technical posts include: *Frank C. Croxton*—member, Board of Visitors, Engineering School, Ohio University; *Iver Igelsrud*—member, Advisory Committee on Scientific Documentation, National Academy of Sciences; *Bertrand A. Landry*—member, Subcommittee II on Sampling of Bulk Materials, Committee II, American Society for Testing Materials; *Alexis W. Lemmon, Jr.* — co-chairman, Summer Conference, American Rocket Society; *David W. Locklin*—member, Research Advisory Committee in Energy Conversion, American Society of Heating, Refrigerating and Air-Conditioning Engineers.

Writings by STAFF Members

The Diffusion of Hydrogen in Beta Zirconium. William M. Albrecht and W. Douglas Goode, Jr., U. S. Atomic Energy Commission, BMI-1373, August 25, 1959, pp. 10. (OTS $0.50)

Zirconium disks, 0.03 to 0.1 cm thick and varying in hydrogen concentration from 9 to 33 a/o, were used to measure permeation rates. The diffusion coefficients determined by the steady-state and time-lag methods on samples of differing thickness were in agreement. It was concluded that the permeation process was diffusion controlled. The diffusion coefficients were found to be independent of concentration and can be expressed by $D = 6.14 \times 10^4 \exp(-45{,}900/RT)$.

The Preparation and Properties of Aluminum Antimonide. W. P. Allred, W. L. Mefferd, and R. K. Willardson. *Electrochemical Society, Journal,* v. 107, February, 1960, pp. 117-122.

An improved method of growing single crystals of aluminum antimonide is described. Oxide from the aluminum has been eliminated by a vacuum heat-treating technique which also removes volatile impurities. The mobility of the positive carriers in AlSb at 300 K is found to be greater than 400 cm^2/v-sec. Values as high as 5000 cm^2/v-sec have been measured at 50 K. The p-type impurities have an activation energy of about 0.02 ev in AlSb. A maximum is observed at 4000 gauss in the magnetic-field dependence of the Hall coefficient at 77 K.

The Effect of Presetting Helical Compression Springs. T. J. Atterbury and W. B. Dibolly, Jr. *ASME, Transactions, Series B, Journal of Engineering for Industry,* v. 82, no. 1, February, 1960, pp. 41-46.

A procedure for predicting the increase in fatigue load carrying capacity due to presetting helical springs is developed, based on the actual stress-strain curve of a material. Resonable correlation with experimental results is obtained. For the cyclic load conditions and the material chosen, an increase in load carrying capacity of 21 per cent was observed. It is expected that an increase of approximately 40 per cent could be realized with slight modification of fabrication techniques.

Theory of Displacement Cascades in Compounds. E. M. Baroody. *Physical Review,* v. 116, 2nd ser., no. 6, December 15, 1959, pp. 1418-1424.

The theory undertakes the determination for a simple model, of functions $N_{1k}(T)$ which represent the numbers of atoms of atoms of various kinds displaced when a primary atom receives an energy T. Assuming isotropic collisions involving pairs of free atoms, differential equations are formulated which contain concentrations, collision cross sections and mass ratios as parameters. Binding of the atoms is introduced through initial conditions which define threshold energies for displacement.

Industrial and Engineering Chemistry, v. 52, February, 1960, contains the following writings by staff members:

Processing Low Temperature Lignite Tar. H. R. Batchelder, R. B. Filbert, Jr., and W. H. Mink, pp. 131-136.

Work on tar derived by the low-temperature carbonization of Sandow (Tex.) lignite is described. Separation of the tar into fractions by distillation and studies of the composition of the fractions led to work on separation by means of dual-solvent extraction of the primary tar. A 4-inch-diameter rotating disk contactor was operated to provide information on the effect of operating conditions on yield and quality of the products, as well as to provide material for further characterization studies. A pilot plant capable of processing about 1000 gallons per day is described.

Nitric Acid Manufacture—Theory and Practice. H. A. Sorgenti and G. F. Sachsel, pp. 101-104.

The commercial production and use of nitric acid in the United States are described. Several variants of the ammonia oxidation process are outlined, and the underlying theory of ammonia oxidation, nitric oxide, and nitrogen dioxide absorption in water is summarized. Recent developments include two methods for producing nearly 100% nitric acid and two methods for direct synthesis of nitric oxide.

Status of Electroplated Titanium Coatings on Other Metals and Electroformed Titanium. John G. Beach. PB 143 231; August 30, 1957, 4 pp. (LC mi. $1.80 ph. $1.80)

Application of titanium coatings now is limited to those metals that are not damaged by fused-salt-bath temperatures in the range of 800 to 1000 C, and that do not form weak diffusion alloys with the titanium, and to needs that can justify the cost and problems of working with fused-salt electrolytes.

Measurements of Bulk Lifetime in Silicon. R. W. Beck, C. S. Peet, and A. C. Beer. PB 138 724; December 15, 1958, pp. 31. (LC mi. $3., ph. $6.30)

Problems involved in the use of the photomagnetoelectric effect to measure lifetime in p-type silicon are discussed. Results for a number of specimens with ranging from 20 to 400 mesec show good agreement with photoconductivity-decay measurements. Evidence suggests that the behavior of the specimens studied might be explained of a single recombination level, if account is taken of nonuniform injection of carriers throughout the depth of the sample.

Life Characteristics of Carbon-Film Resistors. H. M. Braner and J. L. Easterday. *Electrical Engineering,* v. 79, February, 1960, pp. 124.

The carbon-film resistor types investigated were ½-watt 237,000-ohm (critical value) resistors and ½-watt 100,000-ohm borocarbon resistors, with a nominal tolerance of ± 1%. Four brands for resistors were included, of which three were deposited-carbon-type and the fourth a borocarbon-film type. It was found that the carbon-film resistors of manufacturers *A, B,* and *C* have average failure rates ranging from about 0.13 to 2.3% per 1,000 hours. In addition, some types of carbon-film resistors exhibited a number of catastrophic failures and case devects, similar to craxing, on the outer surface. The borocarbon-film resistors of manufacturer *D* experienced an average failure rate (using the 2% criterion) of about 10% per 1,000 hours.

The Preparation and Properties of Three Refractory Beryllides. Walston Chubb and Ronald F. Dickerson. U. S. Atomic Energy Commission, BMI-1327, March 3, 1959, pp. 17. (OTS $0.75)

The beryllium compounds $NbBe_{12}$, YBe_{13}, and $ZrBe_{12}$ were prepared by arc melting. The zirconium compound apparently had a tetragonal structure corresponding to $ZrBe_{12}$ and a hardness of 790 Knoop and density of 2.94 g per cm^3. The yttrium compound had a cubic structure corresponding to YBe_{13} and a hardness of 870 Knoop and a density of 2.57 g per cm^3. The niobium compound had a tetragonal structure corresponding to $NbBe_{12}$ and a hardness of 1100 Knoop and a density of 3.14 g per cm^3.

Qualification of Inconel for Nuclear Power Plant Applications. H. R. Copson and W. E. Berry. *Corrosion,* v. 16, *February,* 1960, pp. 123-129.

In order to qualify Inconel for service in the stream generation system of pressurized water nuclear power plants, the behavior of this material was investigated with respect to resistance to corrosion, radioactivity of corrosion products, and fabrication. The present paper presents the corrosion data. Corrosion tests were conducted in simulated primary and secondary reactors waters on Inconel specimens in several conditions of heat treatment and composition. Stressed specimens, weldments, galvanic couples, and crevice specimens were included. Under all conditions a tightly adherent film formed on the specimens and the corrosion rates were comparable to those of austenitic stainless steels. The Inconel alloy does not suffer intergranular attack or stress corrosion cracking in reactor waters.

Progress Relating to Civilian Applications. Russell W. Dayton and Clyde R. Tipton, Jr. U. S. Atomic Energy Commission, BMI-1324, March 1, 1959, pp. 74; BMI-1330, April 1, 1959, pp. 92, BMI-1340, May 1, 1959, pp. 110; BMI-1346, June 1, 1959, pp. 106; and BMI-1357, July 1, 1959, pp. 111. (OTS, each $2.50)

Gives current status of work being done at Battelle on development of nuclear fuel elements, processing of feed materials, design of components, and characterization and evaluation of nuclear metals and other materials.

Ceramic Statistics. Betty Deem and John D. Sullivan. *American Ceramic Society Bulletin*, v. 39, February, 1960, pp. 74-77.

Charts and tables are presented which compare production or consumption of ceramic products with various other materials in the United States. The data indicate that the ceramic industry is keeping pace with other industries in our growing American economy.

Eosinophilic Diagnosis by the Fluorescence Microscopy Method. Heinz Elder. (In German.) Fluoreszenzmikroskopische Eosinophilen-Diagnostik. *Leitz-Mitteilungen für Wissenschaft und Technik*, v. 1, no. 4, February 1960, pp. 113-117.

Describes experimental studies of eosinophilic leucocytes in man and various animals with the help of an "Ortholux" microscope equipped with an "Aristophot" photographic apparatus for fluorescence investigations in transillumination and top illumination (Hg maximum pressure lamp CS 150). This eosinophile counting method permitted greater accuracy (6 to 7% error instead of 13 to 18%), easier storage of smears, and resulted in less fatigue for operating personnel.

Solid Cone in Longitudinal Half-Wave Resonance. Dale Ensminger. *Acoustical Society of America, Journal*, v. 32, February, 1960, pp. 194-196.

Presents design equations for ultrasonic vibrations in conical sections. Formulas have been derived for determining particle velocity, particle velocity amplification, stresses, length, and mechanical impedance of sections of solid cones—lateral dimensions small compared with the wavelength- in longitudinal half-wave resonance. Unlike the velocity amplification factor of the exponentially tapered bar, that of the conical section does not approach infinity but approaches a limit as the ratio of end diameters approaches infinity.

Corrosion of Titanium and Titanium Alloys in Liquid and Gaseous Fluorine. G. L. Ericson, W. K. Boyd, and P. D. Miller. PB 138 763; April 30, 1958, pp. 7. (LC mi. $1.80 ph. $1.80)

Unalloyed titanium and four titanium-base alloys were subjected to a simple preliminary corrosion evaluation in liquid and gaseous fluorine at temperatures between −320 F and + 220 F. All materials exhibit promising corrosion resistance under the test conditions.

Metals in Chemical and Marine Applications. Frederick W. Fink. *Journal of Metals*, v. 12, February, 1960, pp. 146-148.

While over-all performance may dictate Ti, more attention to design or to changes in operating conditions will often allow a less costly material to be substituted. It may, in some cases, be cheaper to change the environment than to use this expensive material. The competition from Ti has spurred interest in some other more established types of materials. For example, there are new alloys being developed in the Ni-base field and in the Cu-base field which will be of interest to those who have material problems for chemical or marine service. Titanium has many potential areas of usefulness, but much more large-scale plant experience is needed before use of Ti can be fully justified. Titanium, and its alloys in chemical and marine service, will continue to have competition from steel and its alloys, Al-base, Ni-base, and special alloys, depending on the situation.

Add Columbium to Killed Steel to Retard Grain Growth. E. E. Fletcher and A. R. Elsea. *Iron Age*, v. 185, no. 1, February 25, 1960, pp. 72-73.

Columbium imparts a strong resistance to grain growth—even in steel killed with two lb per ton of Al; small amounts increase the yield strength of this killed, heat treating grade by as much as 9200 psi. Of the four Cb levels studied, an addition of about ½ lb per ton gives the best mechanical properties. However, if the steelmaker wants extra resistance to grain growth, he may obtain it by a Cd addition of about eight-nine lb per ton.

The Behavior of Lubricated Ball Bearings in Controlled Atmospheres. W. A. Glaeser. *Lubrication Engineering*, v. 16, February, 1960, pp. 56-60.

Ball bearings were run in gaseous atmospheres free of oxygen and water vapor and the influence of this environment on bearing performance studied. The gases used in this study included hydrogen, helium and nitrogen-hydrogen mixture. In general, bearing operation was satisfactory in the gaseous environments, provided they were copiously lubricated with petroleum or turbine oils. Bearing surfaces appeared highly polished after running in pure gases. The polishing effect was most noticeable in bearings operated in hydrogen environment—the rubbing surfaces having a finish comparable to a metallographic polish.

Behavior of Paint Media in Electrostatic Spraying. R. Grossteinbeck, H. Holte, and W. Tullius. *Electroplating and Metal Finishing*, v. 13, February, 1960, pp. 63.

In electrostatic spraying, drop size and velocity affect the quality of the paint coating while the spray angels provide an indication of the ability of the paint to reach all surfaces of the work presented to the spray. Therefore, when the composition is known, measurements of the conductivity or dielectric constant of the paint and provide some indication of its probable behavior in electrostatic spraying.

Spray Deposition of Calcium Metal on Nickel or Inconel. Albert F. Haskins and Robert M. Evans. U. S. Atomic Energy Commission, BMI-1371, August 24, 1959, pp. 10. (OTS $0.50)

The inert-gas arc-spray method was studied in an effort to develop a continuous process for coating metals with calcium. Duplex electrode arc-spray equipment was used throughout the investigation. While the process appeared feasible, vapors produced during arc spraying and generally poor adhesion of the Calcium to the base metal were considered the major deterrents to the process. The plasma-jet process improved bonding but further research would be necessary to effect uniform coatings of Calcium. The present state in Europe of arc-metal spraying was reviewed. No information on specific techniques was located in the literature.

Combustion Research at Battelle. H. R. Hazard and A. A. Putnam. *Institute of Fuel, Journal*, v. 33, January 1960, pp. 22-31 + 8 plates.

The Institute is now actively serving and in the future will actively continue to serve all the energy industries in the conduct of research aimed at better serving the seemingly insatiable demands for energy of industry and the public. Areas of continuing interest which can be foreseen are related to further improvements and refinement of currently available equipment, fundamental studies to advance the state of the art, and the development of an industrial technology based on much higher temperatures and reaction rates than those currently used.

A Symmetrization Different From That of Steiner. J. Hersch. *Enseignement Mathematique*, v. 5, no. 3, 1959, pp. 219.

If one cuts a plane domain D with a straight line and adds to each part an area symmetrical with respect to the line, two symmetrical domains D_a and D_b, are obtained. Inequalities be-

HOW TO GET COPIES

Reports, unless otherwise indicated, must be purchased prepaid directly from the Office of Technical Services, U. S. Department of Commerce (designated OTS), Washington 25, D. C. or from the Publication Board, Library of Congress (designated LC), Washington 25, D. C. The PB number or, in the case of the U. S. Atomic Energy Commission Reports, the AEC number of the report must be listed with the order. • *Federal agencies and government contractors, their sub-contractors, and suppliers may obtain DMIC Reports gratis from the Defense Metals Information Center, 505 King Avenue, Columbus 1, Ohio.* • *In most cases, gratis copies of articles and papers are available from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.*

tween electrostatic capacities, torsional rigidites and fundamental frequencies of D, D_a, D_b can then be determined by variational methods. These inequalities coincide with those of G. Choquet, M. Aissen, and G. Polya, who worked recently on similar problems; they called this process "alternate symmetrization".

The Effect of Rhenium on the Fabricability and Ductility of Molybdenum and Tungsten. R. I. Jaffee, C. T. Sims, and J. J. Harwood. Paper from *Plansee Proceedings, 1958*, Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna, 1959, pp. 380-411.

The addition of 50% rhenium (35 atomic per cent) to molybdenum results in the development of remarkable hot plasticity and low temperature ductility. In arc-cast unalloyed molybdenum, very small amounts of oxide produce a phase with low dihedral angle, which requires deoxidation. In contrast the molybdenum-rhenium alloy will tolerate at least 500 ppm oxygen in the as-cast condition and still be capable of direct hot working. The oxide redistribution mechanism found for molybdenum-rhenium appears to apply to tungsten-rhenium. Although the low-temperature twinning mechanism is operative, low temperature ductility is not attained, perhaps because of the inability of the matrix to provide the necessary accommodation slip. As a result, about 30% rhenium greatly aids the hot workability to tungsten but is less benefit in ductility at low temperature.

A Practical Controlled Source of Hydrogen. Catalyzed Hydrolysis of Sodium Borohydride. Arthur Levy, John B. Brown, and Carl J. Lyons. *Industrial and Engineering Chemistry*, v. 52, March, 1960, pp. 211-214.

Kinetic studies of the cobalt-catalyzed hydrolysis of $NaBH_4$ have shown that the rate of evolution of hydrogen can be expressed by $-d(NaBH_4/dt - 1.45 \times 10^{13} CoCl_2)-(NaBH_4)^{0.89_6} - 17500/RT$. An increase in starting temperature of 5 C decreases the time for complete reaction by about 50% in an adiabatic reaction. The catalyst-forming reaction, as indicated by data for the reaction of excess $CoCl_2$ with $NaBH_4$, is $2CoCl_2 + 4NaBH_4 + 6H_20 \rightarrow (2Co.B) + 3HBO_3 + 12\ 1/2H_2 + 4NaCl$. Various quantities of H can be generated at different rates by controlling the concentration of catalyst. The catalyst requirements for any set of generation conditions are a function of several variables: initial reaction temperature, thermal losses, and time for homogeneous dispersion of the catalyst.

The Metallography of Indium Antimonide. R. E. Maringer and J. J. Duga. PB 138 717; January 15, 1958, pp. 12. (LC mi. $2.40, ph. $3.30)

Metallographic techniques were developed to observe dislocated etch-pit arrays in polycrystalline and single-crystal InSb in a study of the effects of deformation and of annealing on deformed InSb. Slip bands, deformation bands, twins, grain-boundary migration, and a number of other deformation effects were visible, all of which are commonly observed during the deformation of metals. Metallographic examination of a re-etched sample which was annealed for 2 hr at 500 C (25° below the melting point of InSb), failed to show any evidence of recrystallization.

Examples of Two Technical Inquiries, the Answers, and the Resulting Technical Memoranda. Daniel J. Maykuth. PB 138 930; September 30, 1957, pp. 55. (LC mi. $3.60, ph. $9.30)

Gives data on (1) availability of thin-gage titanium alloy sheet, (2) recent advances in the rolling of thin-gage titanium alloy sheet, and (3) corrosion of titanium and titanium-base alloys in liquid and gaseous fluorine.

Determination of the Mineral Constituents and of the Analytic Composition of Mineral Mixtures by Means of Combined X-Ray Diffraction and X-Ray Spectrography. W. Miedreich. (In German.) Die Bestimmung des Mineralbestandes und der analytischen Zusammenstezung von Mineralgemischen durch kombinierte Röntgen-Beugung und Röntgenspektrographie. Paper from *XV International Congress of Pure and Applied Chemistry (Analytical Chemistry), Proceedings, 1956*, v. II. Lisbon. 1958, pp. 322.

With the help of some analyses of mineral mixtures it was shown that an X-ray interference goniometer can be used advantageously for the determination of the mineral constituents, and of the amount of elements having an atomic number higher than about 20. The instrument used could be converted into a spectrometer with little manipulation involved. It could further be used as a counter tube interference goniometer for recording the diffraction to identify the minerals.

Design Information on 5Cr Alloy Steels for Aircraft and Missiles. F. R. Morral, R. J. Favor, and W. P. Achbach. Pb 151 072; August 28, 1959, pp. 48. (OTS $1.25)

This report is a summary of design information pertinent to the use of the 5Cr-Mo-V(H-11 type) alloy steels in aircraft and missile applications. Heat treatment, melting practice, and corrosion protection are considered. Manufacturing problems such as machining, forming, and joining are also briefly discussed. Data on the elevated-temperature mechanical properties of these H-11 type steels have been collected and evaluated. The presentation and evaluation of these data were in accordance with procedures employed by the ANC-5 Committee.

Four Ways to Calculate Planetary Gear Trains. William H. Wilkinson. *Machine Design*, v. 32, January 7, 1960, pp. 155-159.

Planetary gear trains can become complicated. Motions of components and their relationships are not always apparent. Thus, analyzing planetary gear trains is not a "handbook" matter; basic understanding is required. Four methods of general approach are presented which give this fundamental insight: the energy, graphical, relative-velocity and tabular methods. Of the four, the graphical method is best for quick checks.

Corrosion-Fatigue in Two Hot Work Die Steels. D. N. Williams, M. L. Kohn, R. M. Evans, and R. I. Jaffee. *Modern Castings*, v. 37, January, 1960, pp. 19-25.

Two hot-work die steels, H21 and H23, were examined. It was found that sample life in the range of 1100 F to 1400 F was relatively independent of oxidation. Variations in heat treatments, test conditions or other material properties were found to affect sample life in direct proportion to their effect on the plastic strain imposed on the sample during cyclic loading.

High-Temperature X-Ray Diffraction Investigation of the Uranium-Carbon System. W. B. Wilson. American Ceramic Society, *Journal*, v. 43, February, 1960, pp. 77-81.

The system $UC-UC_2$ was investigated at temperatures to 2200 C. UC_2, which has the CaC structure, was shown to transform to the CaF_2 structure at 1820 C. Mean coefficients of expansion of UC, U_2C_3, and UC_2 were determined. The decomposition of U_2C_3 to cubic UC_2 and to UC saturated metastably with carbon was observed. Solubilities of UC in UC_2 and UC_2 in UC were determined near 1800 C by a method based on lattice-parameter measurements.. The formation of, and existence conditions for, U_2C_3 were confirmed. It was observed that UC_2 tends to decompose toward UC at the extreme temperatures, probably by loss of C to CO.

Electron Microscopical Examination of Bonds in Zircaloy-2. Arthur P. Young and Charles M. Schwartz. U. S. Atomic Energy Commission, BMI-1364, July 29, 1959, pp. 28. (OTS–$1.)

Chemically pickled samples and a zirconium oxide-coated sample pressure bonded at 1500 F and 10,000 psi had pitting at bond lines that could have been due to voids or to contaminant at the interface which etched out. The pitting was almost completely eliminated in one sample by pressing one hour at 500 F and 350,000 psi. This indicated that the bond-line pitting in these samples was due to voids at the interface. It is proposed that grain growth across the interface in chemically pickled samples may have been inhibited by the presence of a thin contaminate film originally present on the Zircaloy surfaces. However, the poor grain-growth characteristics of chemically pickled samples may also be due in part to the surfaces being too smooth.

BATTELLE
TECHNICAL
REVIEW

ABSTRACTS

Volume 9, Number 5
May 1960

Administration and Philosophy of Research . . . 261a
Aeronautical and Astronautical Engineering . . . 261a
Agriculture . . . 264a
Biochemistry and Biophysics . . . 264a
Ceramics and Concrete . . . 268a
Chemical Engineering . . . 269a
Chemistry—Analytical . . . 272a
Chemistry—Inorganic and General . . . 274a
Chemistry—Organic . . . 275a
Chemistry—Physical . . . 278a
Coatings . . . 280a
Control Systems, Computers, and Systems Engineering 282a
Electrical Engineering . . . 283a
Electrochemistry . . . 284a
Electronics . . . 285a
Engineering Economics . . . 289a
Fluid Mechanics . . . 290a
Food Technology . . . 291a
Fuels and Combustion . . . 291a
Geology, Geophysics, Mineralogy and Mining Engineering . . . 292a
Graphic Arts . . . 294a
Heat Power . . . 295a
Information—Preparation and Dissemination . . . 296a
Instrumentation . . . 297a
Lubrication and Friction . . . 297a
Mechanical Engineering . . . 298a
Metallurgy . . . 300a
Metals—Corrosion . . . 300a
Metals—Extraction and Refining . . . 301a
Metals—Finishing, Polishing, and Cleaning . . . 302a
Metals—Foundry Practice . . . 302a
Metals—Heat Treatment . . . 302a
Metals—Mechanical and Physical Properties . . . 303a
Metals—Mechanical Working . . . 304a
Metals—Metallography, Transformations, and Structures . . . 306a
Metals—Powder . . . 309a
Nondestructive Testing and Quality Control . . . 309a
Nuclear Physics, Nucleonics, and Radiation . . . 310a
Operations Research . . . 312a
Ore and Materials Beneficiation . . . 313a
Physics . . . 314a
Plastics . . . 315a
Pollution and Wastes . . . 318a
Rubber and Elastomers . . . 318a
Space Heating and Conditioning . . . 319a
Textiles, Fibers, Leather, and Paper . . . 319a
Welding and Joining . . . 320a

ADMINISTRATION AND PHILOSOPHY OF RESEARCH

4998 Engineering's Great Challenge—the 1960's. The challenges of basic research in the 1960's are, in large part, engineering challenges. It should be a great decade if the profession meets these challenges as it has shown itself able to do in the past. ***John T. Kane.*** *American Engineer,* v. 31, Feb. 1960, p. 21 + 8 pages.

4999 American Universities and Federal Research. The central thesis is that large-scale federal financing of research has set in motion irreversible forces that are affecting the nature of universities, altering their capacity to teach, changing their financial status, modifying the character of parts of the federal administrative structure, establishing new political relations, and changing the way research itself is organized. ***Charles V. Kidd.*** 272 pp. 1959. Belknap Press of Harvard University Press, Cambridge, Mass. (Q180.U5 K53a)

5000* The Major Barrier to Creativity in Industrial Laboratories. The unpredictable nature of the creative process makes it often suspect to management. The majority of the panelists offered many instances where management's insistence on order, predictability, and profits provided barriers for the creative researcher. ***Eugene Raudsepp.*** *Electromechanical Design,* v. 4, no. 2, Feb. 1960, p. 44-47.

5001 The IR 1960 Forecast: $13-Billion for Research. Expect in 1960: dramatic advances toward controlling thermonuclear power; a Russian soft landing on the moon, possibly manned; a U. S. unmanned moon landing; an American in orbit; space probes to Mars, Venus, and the sun; computers 1,000 times faster than present ones; new antiradiation drugs; stronger steel alloys; gas-lubricated bearings operable at very high and very low temperatures. ***S. David Pursglove.*** *Industrial Research,* v. 2, no. 1, Feb.-Mar., 1960, p. 12-21.

5002 Grace & Co.'s Headstart. Selling and producing a chemical before research facilities were established gave an essentially non-chemical company the entrance it needed. The experience provided the basis of a large R&D effort to come. ***William P. Gage.*** *Industrial Research,* v. 2, no. 1, Feb.-Mar. 1960, p. 74-79.

5003 Research and Technology: A New Era Begins. Shows that the economy stands only a few short years from a dynamic consumer and industrial revolution based on the outgrowth of present research programs. ***Dexter M. Keezer.*** *Management Review,* v. 49, Feb. 1960, p. 23 + 15 pages.

5004 Research Methodology at the London School of Economics. The author, who is director of the Research Techniques Division of the school, gives a brief summary of the present work of his division. ***M. G. Kendall.*** *Nature,* v. 185, Jan. 23, 1960, p. 208-209.

5005* The Science Program in the Department of State. The Office of the Science Advisor to the Secretary of State carries on a broad program of improving awareness of science activities in both the U. S. and foreign countries. ***Raymund L. Zwemer.*** *Special Libraries,* v. 51, no. 1, Jan. 1960, p. 16-17.

5006 The Two Cultures and the Scientific Revolution. Points to the great gulf that lies today between the men of science and those who are called literary or "intellectual". The last of communication between these two groups, these two cultures, could be fatal to the Western world. ***C. P. Snow.*** 58 pp. 1959. Cambridge University Press, New York. (Q171 Sn61t)

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

5007 Thermodynamic Properties of Air in the Temperature Interval From 1000 to 12,000 K and the Pressure Intervals From 0.001 to 1000 atm. *E. V. Stupochenko,*

---

*Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed are available for interlibrary loan.

I. P. Stakhanov, E. V. Samuilov, A. S. Pleshanov, and I. B. Rozhdestvenskii. *ARS Journal*, v. 30, Jan. 1960, p. 98-112.

5008 Rapid Approximate Method for Analyzing Nuclear Rocket Performance. The effects of core geometry and surface temperature limitations on nuclear rocket performance are studied using the heat transfer friction analogy and one-dimensional gas dynamics. Approximate relationships between thrust coefficient, specific impulse, core geometry and maximum surface temperature are obtained. High thrust coefficient and high specific impulse are not compatible, and a compromise must be made between these two requirements. ***Alan H. Stenning.*** *ARS Journal*, v. 30, Feb. 1960, p. 169-172.

5009 Advanced Propulsion Systems. Proceedings of a Symposium Held in Los Angeles, California, December 11-13, 1957. Concepts of physical propulsion; power sources and new propellants; hardware; human hazards of space flight. ***Morton Alperin and George P. Sutton, editors.*** 237 pp. 1959. Pergamon Press, N. Y. (TL783.5 Ad95a)

5010 Advances in Aeronautical Sciences. v. I-II. Survey papers on principles of inertial guidance, boundary layer control, VTOL/STOL aircraft, heat resisting materials, heat transfer and the heat barrier, jet noise, human factors in aeronautics, hypersonic speeds, propulsion methods in space, and magneto-fluid dynamics. ***Th. von Kármán, editor.*** v. I. 562 pp; v. II. 581 pp. 1959. Pergamon Press, New York. (TL505 In8p)

5011 Advances in Space Science. Interplanetary rocket trajectories; interplanetary communications; power supplies for orbital and space vehicles; manned space cabin systems; radiation and man in space; nutrition in space flight. ***Frederick I. Ordway, III, editor.*** v. I. 412 pp. 1959. Academic Press, New York. (TL787 Ad95 Vis.)

5012 Manned Nuclear Space Systems: I. High-Thrust Nuclear Systems. Discusses the high-thrust nuclear system in the performance of the Martian mission. In order to achieve interplanetary flight with large payloads, nuclear reactors will be used as heat sources for high-thrust rockets and/or electrical propulsion. ***E. B. Konecci, R. F. Trapp, and M. W. Hunter.*** *Aero/Space Engineering*, v. 19, Jan. 1960, p. 34-41.

5013 Optimum Rocket Trajectories. I. Initial Value Variational Solutions. Briefly outlines the physical and mathematical bases required for the solution of optimum trajectory problems on an initial value basis. More involved problems are solved in the same fashion, except that the mathematical manipulations become considerably more complex. ***Daniel O. Dommasch and Roger L. Barron.*** *Aero/Space Engineering*, v. 19, Jan. 1960, p. 46 + 5 pages.

5014 Aerodynamically Heated Surfaces — A Chemical Analysis. Chemical behavior of ablative missile surfaces, including both decomposition reactions and mass transfer. ***Howard Myers.*** *Aero/Space Engineering*, v. 19, Feb. 1960, p. 34-38.

5015 Flight Dynamics of Large External Stores. Application of flight flutter investigational experiences as a guide to the preliminary design and flight testing of relatively large external stores, such as cargo packs or external wing fuel tanks. ***Arnold P. Schaffer.*** *Aero/Space Engineering*, v. 19, Feb. 1960, p. 39-44.

5016 Optimum Rocket Trajectories. II. Generalized Boost Analysis. Physical and mathematical bases required for the solution of optimum trajectory problems on an initial value basis. Results obtained using digital computer techniques for step-by-step integration of the optimum equation set, starting from a given set of initial conditions. ***Daniel O. Dommasch and Roger L. Barron.*** *Aero/Space Engineering*, v. 19, Feb. 1960, p. 45-48.

5017 Effectiveness of Propellers at High Speeds. A Simplified Analysis of the Operation and Effectiveness of Propellers and Helicopter Rotors at Transonic Speeds. The operating conditions of a conventional airfoil-type propeller or helicopter rotor in both subsonic and supersonic regions are separately considered, in the absence of direct shock and blade interference effects and other disturbances. The performance of a propeller or rotor is approximately predicted by applying the conventional strip-type analysis and the results of the two-dimensional airfoil theory. ***Svetopolk Pivko.*** *Aircraft Engineering*, v. 31, Dec. 1959, p. 360-364.

5018* The Estimation of Tail Loading Due to Elevator-Induced Pitching Manoeuvres. A Proposal for an Approximate Analytical Method for Airworthiness Calculations. I. Qualitative Discussion. Discusses general reasons for considering a fresh approach to the calculation of airworthiness-design tail loads and associated torques due to elevator-induced pitching maneuvers; description of the maneuver itself; elevator actions to be assumed; and proposed method of calculating the various response quantities. Deals with the application of the work to autopilot feed-back failure causing hunting of the elevator control. The effects of aircraft size, weight, c.g. position, forward-speed and altitude on the various response quantities are discussed, with particular emphasis on the importance of the maneuver margin. ***P. F. Richards.*** *Aircraft Engineering*, v. 32, Jan. 1960, p. 2-15.

5019* Magnesium and Aircraft Engineering. Properties of Mg alloys which are of special interest and concern in aeronautics. ***A. J. Kennedy and A. R. Sollars.*** *Aircraft Engineering*, v. 32, Jan. 1960, p. 16-22.

5020* Nomogram Analysis for Ducted Fans With Pre-Rotation. Analysis of flow condition in which an upstream swirl velocity exists. ***M. M. Gibson and J. F. Norbury.*** *Aircraft Engineering*, v. 32, Jan. 1960, p. 23 + 2 pages.

5021 Review of Panel Flutter and Effects of Aerodynamic Noise. II. Structural Effects of Aerodynamic Noise. Effects of jet noise on aircraft structures. ***L. E. Goodman and J. V. Rattayya.*** *Applied Mechanics Reviews*, v. 13, Feb. 1960, p. 81-87.

5022* Trajectories of Objects Ejected From Aircraft. A method of calculating the trajectories of objects, such as occupied seats or capsules ejected from an aircraft, is presented to provide a preliminary analytical tool for the evaluation of conditions required to prevent collision of the objects with the tail of the abandoned aircraft. Application of the method is limited to ejections from aircraft flying at high speeds. The method considers trajectories of a rocket-propelled object ejected from an aircraft in symmetrical flight at any altitude, in any pitch attitude with respect to the horizon and experiencing any normal acceleration. ***K. Korsak.*** *Canadian Aeronautical Journal*, v. 6, no. 1, Jan. 1960, p. 3-9.

5023* Half Model Testing in Wind Tunnels. A review is given of the effects associated with half model technique in wind tunnel testing. These include tunnel wall boundary layer and gap between model and tunnel wall. Reflection plane configurations are considered. Some experimental data on comparison between full and half model tests are given. ***J. A. van der Bliek.*** *Canadian Aeronautical Journal*, v. 6, no. 2, Feb. 1960, p. 59-68.

5024 Foundations of Aerodynamics. Energy relations; one dimensional compressible flow theory; wings in compressible flow; lifting surface theory; compressibility in laminar and turbulent flow; isotropic turbulence. ***A. M. Kuethe and J. D. Schetzer.*** 2nd Ed. 446 pp. 1959. John Wiley & Sons, New York. (TL570 K95f2)

5025 High Strength Steels for Aircraft. A compilation of papers presented at the Southwestern Metal Congress, May 12-16, 1958. 81 pp. American Society for Metals, Cleveland. (TL699.S8 S89h)

5026 IXth International Astronautical Congress, Amsterdam 1958, Proceedings. v. I and II. Papers cover astronautics, astrophysics, propulsion, artificial satellites, and space biology and medicine. ***F. Hecht, editor.*** v. I. 506 pp. v. II. 464 pp. 1959. Springer-Verlag, Austria. (TL787 In8p9)

5027 Sublimation in a Hypersonic Environment. In this study of hypersonic ablation, the pertinent conservation equations are derived and the simultaneous processes of diffusion, convection, and thermal exchange are analyzed for the vaporization of a refractory material which is subjected to the environmental conditions encountered during hypersonic reentry. For simplicity, only the forward stagnation point of an axially symmetric body is treated. It is shown that the

quantity Q, called the effective heat of vaporization, which includes all heat absorbing or heat blocking effects, is an increasing function of flight speed. ***Sinclaire M. Scala.*** *Journal of the Aero/Space Sciences*, v. 27, Jan. 1960, p. 1-12.

5028 Wings With Minimum Drag Due to Lift in Supersonic Flow. In order to produce minimum drag, the given lift must be distributed over the wing surface in such a way that the sum of the downwash induced by this distribution and the downwash induced in reversed flow is constant over the wing surface. This combined downwash can be expressed by an integral which contains the load as a function of the spanwise and chordwise coordinate. ***Ingeborg Ginzel and Hans Multhopp.*** *Journal of the Aero/Space Sciences*, v. 27, Jan. 1960, p. 13 + 8 pages.

5029 Turbulent Heat Transfer on Blunt-Nosed Bodies in Two-Dimensional and General Three-Dimensional Hypersonic Flow. In the presence of highly cooled surfaces and of moderate Mach Numbers of the outer stream, the crossflow and the pertaining Reynolds stresses in a general three-dimensional turbulent boundary layer are negligible, even for large transverse pressure gradients. A correlation is made between two-dimensional compressible and incompressible turbulent boundary layers. ***Roberto Vaglio-Laurin.*** *Journal of the Aero/Space Sciences*, v. 27, Jan. 1960, p. 27-36.

5030 Effectiveness of Radiation as a Structural Cooling Technique for Hypersonic Vehicles. An analysis is made of the more significant effects of internal heat transfer within idealized structures, both with and without external insulation on areas of greatest aerodynamic heating intensity. Selective use of insulation leads to structural temperature reductions substantially greater than those obtained without insulation. ***Roger A. Anderson and William A. Brooks, Jr.*** *Journal of the Aero/Space Sciences*, v. 27, Jan. 1960, p. 41-48.

5031 Compressible Flat-Plate Boundary-Layer Flow With an Applied Magnetic Field. The skin-friction and heat-transfer characteristics are determined for free-stream velocities of up to 17,500 meters/sec. and magnetic fields of up to about 1 weber/(meter)^2. ***William B. Bush.*** *Journal of the Aero/Space Sciences*, v. 27, Jan. 1960, p. 49-58.

5032 Temperature Profiles in a Finite Solid With Moving Boundary. An implicit method of solution is developed with conductivity as an arbitrary function of temperature. Application is made to a sample case of re-entry heating encountered by aerodynamic bodies, with erosion by sublimation and combustion occurring at the body surface. ***C. Forbes Dewey, Jr., Stewart I. Schlesinger, and Lawrence Sashkin.*** *Journal of the Aero/Space Sciences*, v. 27, Jan. 1960, p. 59-64.

5033 Boundary-Layer Transition on Blunt Bodies With Highly Cooled Boundary Layers. The shock tube is shown to be a feasible research tool for conducting boundary-layer transition experiments. Boundary-layer transition investigations were made on optically polished pyrex hemisphere-cylinder and ellipse-cylinder models with stagnation-to wall enthalpy ratios between 4.5 and 30. The models were ½ and 1 in. in diameter with a surface roughness estimated to be less than 1 microinch (*rms*). Transition was detected by measurements of the heat-transfer rates on the model surface. ***Kenneth F. Stetson.*** *Journal of the Aero/Space Sciences*, v. 27, Feb. 1960, p. 81-91.

5034 Transition in a Separated Laminar Boundary Layer. A hot wire investigation of flow near the short leading-edge bubble on a RAE-103 airfoil section led to a study of a boundary-layer transition in the flow past a step. The step investigation represented airfoil bubble conditions approximately and to a larger scale. ***B. H. Lochtenberg.*** *Journal of the Aero/Space Sciences*, v. 27, Feb. 1960, p. 91-96.

5035 Application of Power Spectral Methods in Airplane and Missile Design. Illustrates some applications of power-spectral methods in the determination of dynamic loadings and response for both airplanes and missiles subject to continuous turbulence. Input-transfer-function-output relationships are discussed and a procedure outlined whereby mission design load information may be obtained utilizing high-speed digital computing equipment. ***Kenneth R. Thorson and Quentin R. Bohne.*** *Journal of the Aero/Space Sciences*, v. 27, Feb. 1960, p. 107-116.

5036 Propagation of Weak Disturbances in a Gas Subject to Relaxation Effects. A generalized wave equation is derived for sound disturbances in a gas when relaxation effects connected with, for example, molecular vibration or dissociation are important. Solutions involving discontinuous wave fronts are presented, and it is shown that, under certain assumptions, the complete wave equation reduces to a variant to the telegraph equation. This study is viewed as a step in the development of a theory of small disturbances of a high-temperature gas, as is found behind the shock in hypersonic flight. ***Franklin K. Moore and Walter E. Gibson.*** *Journal of the Aero/Space Sciences*, v. 27, Feb. 1960, p. 117-127.

5037 Aireraft Seating—Forward Facing? Or Rearward? Presents a method for determining when to trade the benefits of one seat type for another. ***I. Irving Pinkel.*** *Mechanical Engineering*, v. 82, Feb. 1960, p. 60-63.

5038 Calculation of Aerodynamic Forces on Slowly Oscillating Rectangular Wings in Subsonic Flow. The method is essentially a lifting surface theory which takes into account the unsteady effects due to the wake. Results are given as a series containing terms of increasing powers in reduced frequency. The method is applied to rectangular airfoils. It is shown that if the axis of rotation is ahead of the airfoil, the aerodynamic damping is much less than it would be according to quasi-steady theory. ***A. I. Van De Vooren and E. M. De Jager.*** *Netherlands, National Luchtvaartlaboratorium, Report F*-192, Oct. 1956, 34 pp. (TL526.N3 N38.5r Contin.)

5039* The Imperial College Hypersonic Gun Tunnel, August 1958—July 1959. Reviews progress made with this gun tunnel since August 1958, when it came into operation. The tunnel and instrumentation are described together with the results of various measurements made both in the barrel and in the working section. ***J. L. Stollery, D. J. Maull, and B. J. Belcher.*** *Royal Aeronautical Society, Journal*, v. 64, Jan. 1960, p. 24-32.

5040 The Soviet Air and Rocket Forces. Examines various aspects of Russian thought and experience ranging from the daily life and training of a Soviet airman to the political control of the Soviet Air Force from the past history of Soviet air arms ot a projection of their future. ***Asher Lee, editor.*** 311 pp. 1959. Frederick A. Praeger, New York. (UG635.R9 L51s)

5041 A Method for Solving the Subsonic Problem of the Oscillating Finite Wing With the Aid of High-Speed Digital Computers. An attempt is made to formulate the linearized, subsonic problem of the oscillating finite wing in such a way that its solution can be obtained with the aid of high-speed digital computers. An integral equation for a special function, the integrated acceleration potential, is formulated. The solution is approximated by a linear combination of members in a set of functions, chosen on the basis of two-dimensional theory. ***Valter J. E. Stark.*** *Svenska Aeroplan Aktiebolaget, SAAB Technical Notes-TN*-41, Dec. 16, 1958, 36 pp. (TL504 Sv23t Vis.)

5042 Temperature Response of a Hot-Wire Anemometer to Shock and Rarefaction Waves. The use of the hot-wire anemometer in the study of temperatures behind the incident and reflected shock waves and incident and reflected rarefaction waves is described. The measured temperatures in both cases show good agreement with theory at low diaphragm pressure ratios. The agreement is better for incident waves than for reflected waves. The disagreement progressively increases with increasing diaphragm pressure ratios. ***S. G. Datar.*** *Toronto University, Institute of Aerophysics, UTIA Technical Note No.* 28, June 1959, 36 pp. (TL570 T64.84t Vis.)

5043 Aerodynamic Damping at Mach Numbers of 1.3 and 1.6 of a Control Surface on a Two-Dimensional Wing by the Free-Oscillation Method. Test results are compared with results calculated by two- and three-dimensional oscillating air-force theories. At a Mach number of 1.6, both theories are in fairly good agreement with the experimental results. At a Mach number of 1.3, both theories predict negative (unstable) damping, whereas the tests indicate that the damping is slightly positive (stable). The in-phase or aerodynamic stiffness coefficients predicted by both theories are slightly

higher than the experimentally determined coefficients. ***W. J. Tuovila and Robert W. Hess.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-116, Feb. 1960, 21 pp. (TL570 Un3t Vis.)

5044 Free-Flight Investigation at Mach Numbers Between 0.5 and 1.7 of the Zero-Lift Rolling Effectiveness and Drag of Various Surface, Spoiler, and Jet Controls on an 80° Delta-Wing Missile. Tests were made to substantiate simple theory for deflected surfaces, and to determine some effects of chordwise location for spoilers and blowing direction and spanwise location for jets. The fuselage shape was modified for one case. The results demonstrated that all controls were satisfactory roll-producing devices except the canards immediately forward of the main wings and the spoilers at other than trailing-edge locations. ***Eugene D. Schult.*** *U. S. National Aeronautics and Space Administration, Technical note, NASA TN*-D-205, Feb. 1960, 47 pp. (TL570 Un3t Vis.)

5045 Nearly Circular Transfer Trajectories for Descending Satellites. Simplified expressions describing the transfer from a satellite orbit to the point of atmospheric entry are derived. The expressions are limited to altitude changes that are small compared with the earth's radius, and velocity changes small compared with satellite velocity. They are further restricted to motion about a spherical, nonrotating earth. The transfer orbit resulting from the application of thrust in any direction at any point in an elliptic orbit is considered. Expressions for the errors in distance (miss distance) and entry angle due to an initial misalignment and magnitude error of the deflecting thrust are presented. ***George M. Low,*** *U. S. National Aeronautics and Space Administration, Technical Report, NASA TR*-R-3, 1959, 17 pp. (TL521 Un3ra Vis.)

5046 Effects of Mach Number and Wall-Temperature Ratio on Turbulent Heat Transfer at Mach Numbers From 3 to 5. Heat-transfer data were evaluated from temperature-time histories measured on a cooled cone-cylinder model with turbulent flow at Mach numbers 3.00, 3.44, 4.08, 4.56, and 5.04. The effects of Mach number and wall-temperature ratio on Stanton number are compared with predictions from existing theories. ***Thorval Tendeland.*** *U. S. National Aeronautics and Space Administration, Technical Report, NASA TR*-R-16, 1959, 15 pp. (TL521 Un3ra Vis.)

5047 A Systematic Kernel Function Procedure for Determining Aerodynamic Forces on Oscillating or Steady Finite Wings at Subsonic Speeds. Details are given of a numerical solution of the integral equation which relates oscillatory or steady lift and downwash distributions in subsonic flow. The procedure was programed for the IBM 704 electronic data processing machine and yields the pressure distribution and some of its integrated properties for a given Mach number and frequency and for several modes of oscillation in from 3 to 4 minutes. Results of several applications are presented. ***Charles E. Watkins, Donald S. Woolston, and Herbert J. Cunningham.*** *U. S. National Aeronautics and Space Administration, Technical Report, NASA TR*-R-48, 1959, 48 pp. (TL521 Un3ra Vis.)

5048 Similarity of Far Noise Fields of Jets. Similarity parameters from subsonic and supersonic jets issuing from circular nozzles are derived and tested using experimental data. Relations for the total acoustic power, acoustic-power spectrum, acoustic directivity, local mean-square-pressure spectrum, and acoustic-pressure probability-density are considered. Subsonic data correlated well in all respects. With the exception of total-power similarity, supersonic data also correlated well. Subsonic and supersonic correlations generally differed only slightly. ***Walton L. Howes.*** *U. S. National Aeronautics and Space Administration, Technical Report, NASA TR*-R-52, 1959, 90 pp. (TL521 Un3ra Vis.)

5049 An Analysis of the Corridor and Guidance Requirements for Supercircular Entry Into Planetary Atmospheres. The analysis is developed around a new dimensionless parameter which combines certain conditions at the conic perigee altitude with certain characteristics of the vehicle; this parameter conveniently determines either deceleration-limited or heating-limited corridor widths for elliptic, parabolic, or hyperbolic approach trajectories. Presents illustrative calculations of corridor widths and the associated guidance problems for Venus, Earth, Mars, Jupiter, and Titan. Generalized curves are presented for application to various entry conditions. ***Dean R. Chapman.*** *U. S. National Aeronautics and Space Administration, Technical Report, NASA TR*-R-55, 1959, 76 pp. (TL521 Un3ra Vis.)

See also: **5608** (turbulence and drag reduction).

AGRICULTURE

5050* Experiment on Raising Phytophagous Insects Upon Artificial Media. *(In Russian.)* Opyt vospitaniya nekotorykh nasekomykh-fitofagov na iskusstvennykh sredakh. ***E. M. Shumakov, N. M. Edel'man and A. E. Borisova.*** *Akademiia Nauk SSSR, Doklady,* v. 130, no. 1, Jan.-Feb. 1960, p. 237-240.

5051* The Influence of the Extract of Some Crops and Soil Residues of Germination and Growth. Alfalfa extract caused the greatest reduction in shoot and root length as well as in percentage germination. It caused the greatest increase in the time required for germination. Timothy extract was not quite as harmful as the alfalfa. Extracts of oats, corn and potatoes were still less harmful with potato extract causing the least effect. ***K. F. Nielsen, T. F. Cuddy, and W. B. Woods.*** *Canadian Journal of Plant Science,* v. 40, no. 1, Jan. 1960, p. 188-197.

5052* Effects of Sevin on Phytophagous Mites and Predators in an Ontario Peach Orchard. Numbers of the European red mite *(Panonychus)* increased but those of the brown mite *(Bryobia)* and the peach silver mite *(Vasates)* decreased after sprays. Sevin practically eliminated the predacious mite *Typhlodromus rhenanus* Oudms., and larvae and pupae of *Stethorus punctillum* Weise. ***Wm. L. Putman and D. C. Herne.*** *Canadian Journal of Plant Science,* v. 40, no. 1, Jan. 1960, p. 198-201.

5053 Hydroponics, the Bengal System. A popular, nontechnical text dealing with the method. ***J. Sholto Douglas.*** 3rd Ed. 144 pp. 1959. Oxford University Press, London. (SB139 Sh74h)

5054 New Pests of Cocoa *(Theobroma Cacao L.)* in Ghana Following Applications of Insecticides. ***P. F. Entwistle, C. G. Johnson, and E. Dunn.*** *Nature* (Suppl. No. 26), v. 184, Dec. 26, 1959, p. 2040.

5055* Chemotherapy for Plant Diseases. Control of plant insect pests with chemicals which can move in the plant and exert their action from within the tissues has been successfully accomplished. The control of plant disease by similar methods presents greater problems, but research in this field is proceeding on many fronts. ***R. L. Wain.*** *New Scientist,* v. 7, Jan. 7, 1960, p. 41-43.

5056 Plant Physiology, a Treatise. v. II. Plants in Relation to Water and Solutes. Designed for the use of advanced and postgraduate students, teachers, research workers, and investigators in other fields of knowledge who need information about the present status of plant physiology. ***F. C. Steward, editor.*** v. II. 758 pp. 1959. Academic Press, New York. (QK711 St49p)

See also: **5160** (weed control chemicals).

BIOCHEMISTRY AND BIOPHYSICS

5057* Local Chemical Protection of the Skin Against Roentgen Radiation Injury. ***B. Fogh.*** *Acta Radiologica,* v. 53, no. 1, Jan. 1960, p. 49-56.

5058* The Culture Collection of Algae at Indiana University. The cultures are available to all interested individuals and organizations, both academic and commercial. To academic

institutions and nonprofit organizations the cost per culture is $1.00, postpaid. ***Richard C. Starr.*** *American Journal of Botany*, v. 47, no. 1, Jan. 1960, p. 67-86.

5059* The Concentration and Collision Frequency of Microsomal Particles and Supernatant RNA in Rabbit Reticulocytes. The concentration of particles and S-RNA in the cell was found to be 3×10^{-6} and 6×10^{-5}, respectively. The collision frequency has been calculated from Smoluchowski's equation. The results indicate that if more than 0.01% of the collisions result in amino acid transfer, then the collision frequency is sufficient to support the rate of peptide-bond synthesis which is actually observed. ***Paul O. P. Ts'o and Alice Lubell.*** *Archives of Biochemistry and Biophysics*, v. 86, no. 1, Jan. 1960, p. 19-24.

5060* The Relationships Between Steroid Molecular Structure and Cell Growth. The growth rate of the chlorotic, free-living flagellate *Euglena* is accelerated by androgenic, estrogenic, and adrenal steroid hormones at concentrations as low as 10^{-4} mg. steroid/l. of culture medium. The structural features necessary for the action of the steroid appear to be either a ketone or hydroxyl grouping at carbons 3 and/or 17 of the nucleus and an over-all planar configuration of the molecule. The data infer that in this growth-accelerating action any role other than that of a catalyst is unlikely for the steroid molecule. ***D. E. Buetow and B. H. Levedahl.*** *Archives of Biochemistry and Biophysics*, v. 86, no. 1, Jan. 1960, p. 34-41.

5061* Soluble Browning Reaction Pigments of Aged Burley Tobacco. I. The Nondialyzable Fraction. A dark-brown pigment, identified as an iron-protein-chlorogenic acid-rutin complex, was isolated by precipitation with acetic acid from the soluble nondialyzable fraction of aged Burley tobacco in an amount corresponding to 0.32% of dry leaf weight. ***H. E. Wright, Jr., W. W. Burton, and R. C. Berry, Jr.*** *Archives of Biochemistry and Biophysics*, v. 86, no. 1, Jan. 1960, p. 94-101.

5062* The SH-Group Content of Human Foetal and Sickle-Cell Haemoglobins. Sickle-cell hemoglobin was found to have the same SH-group content as normal human adult hemoglobin, namely 2.2 SH groups per mole in the native protein and 6.0 SH groups per mole in the denatured protein. ***A. C. Allison, R. Cecil, and N. S. Snow.*** *Biochemical Journal*, v. 74, no. 2, Feb. 1960, p. 273-276.

5063* The Relationship Between the Synthesis of Protein and the Synthesis of Ribonucleic Acid in the Connective-Tissue Cell. There is no mandatory coupling between the synthesis of ribonucleic acid and the synthesis of protein, as measured by the over-all rates of the two processes, either in the nucleus or in the cytoplasm. ***H. Harris.*** *Biochemical Journal*, v. 74, no. 2, Feb. 1960, p. 276-279.

5064 Biochemical Preparations. ***Henry A. Lardy, editor.*** v. VII. 102 pp. 1960. John Wiley & Sons, Inc., New York. (QP509 B52p Vis.)

5065* The Use of Paper Chromatography for Observing the Effect of Penicillin on the Amino Compounds Present in Sensitive and Resistant Strains of *Staphylococcus aureus*. ***L. A. Mabbitt and M. Gregory.*** *Biochimica et Biophysica Acta*, v. 37, no. 1, Jan. 1960, p. 139-141.

5066* Deoxyribonucleic Acid Synthesis and Ultraviolet-Induced Mutation. Suggests that irradiation produces premutational damage (mutagens) that may be lost spontaneously or lead to mutation at the time of a "terminal event", and that chloramphenicol reduces mutation frequency by delaying DNA synthesis. ***M. Lieb.*** *Biochimica et Biophysica Acta*, v. 37, no. 1, Jan. 1960, p. 155-157.

5067* Peptides Isolated From Peptic Hydrolysate of Chymotrypsinogen. ***J. Vaněček, B. Meloun, V. Kostka, B. Keil, and F. Sorm.*** *Biochimica et Biophysica Acta*, v. 37, no. 1, Jan. 1960, p. 169-171.

5068* Evidence of the Occurrence of a Large RNA Molecule Per Ribonucleoprotein Particle. A purified RNA preparation consisting of two sedimenting components has been obtained from mouse brains. The molecular weights of these two components, as determined from the sedimentation and viscosity data, are $1.7 \cdot 10^6$ and $0.7 \cdot 10^6$, respectively. The larger value is equal to the RNA content of one mole of the larger tissue ribonucleoprotein. This result supports the previously advanced hypothesis that one RNA particle with a molecular weight of about $1.7 \cdot 10^6$ is contained in one molecule of a certain class of ribonucleoprotein particle. ***Ping-Yao Cheng.*** *Biochimica et Biophysica Acta*, v. 37, no. 2, Jan. 15, 1960, p. 238-242.

5069* Studies on the Biosynthesis of Deoxyribonucleic Acid by Extracts of Mammalian Cells. III. Net Synthesis of Polynucleotides. Net synthesis of polynucleotide amounting to more than 70% of the amount of carrier DNA present was demonstrated by incubation of the deoxynucleoside-5'-monophosphates of adenine, guanine, cytosine and thymine with ATP and the ascites cell extract. ***R. M. S. Smellie, et al.*** *Biochimica et Biophysica Acta*, v. 37, no. 2, Jan. 15, 1960, p. 243-250.

5070* Structural Changes in DNA After X-Radiation *in vivo*. Inhibition of incorporation of ^{32}P produced by 1000 R is accompanied by changes in the molecular pattern of DNA which are consistent with the idea of template damage. ***Margery G. Ord and L. A. Stocken.*** *Biochimica et Biophysica Acta*, v. 37, no. 2, Jan. 15, 1960, p. 352-353.

5071* Effects of Chloramphenicol on RNA Synthesis in Escherichia coli Irradiated With Ultraviolet Light. ***Kenshi Suzuki, Fumio Sawada, and Yukiko Iwama.*** *Biochimica et Biophysica Acta*, v. 37, no. 2, Jan. 15, 1960, p. 369-370.

5072* Some Relations Between Enzyme Activity, Chemical Reactivity and Urea-Induced Disorientations in Ribonuclease. ***E. A. Barnard and W. D. Stein.*** *Biochimica et Biophysica Acta*, v. 37, no. 2, Jan. 15, 1960, p. 371-372.

5073* The Interaction of Polynucleotides With Metal Ions, Amino Acids, and Polyamines. The formation of the two-stranded complex between the Na salts of polyadenylic acid and polyuridylic acid requires the presence in solution of additional cations. It is found that the effect of Mg ion is characteristic of a strong interaction between metal ion and polynucleotide, while the effect of Na ion is characteristic of weak interaction. It is also found that the formation of the two-stranded structure requires neutralization of the charge on the phosfate backbone. ***Gary Felsenfeld and Sylvia Huang.*** *Biochimica et Biophysica Acta*, v. 37, no. 3, Jan. 29, 1960, p. 425-433.

5074* Transfer of DNA-Glucose From Parental to Offspring Phage T2. The DNA of T2 contains glucose attached in glucosidic linkage to the alcoholic group of 5-(hydroxymethyl)cytosine. The experiments showed that labeled glucose is transferred with the same efficiency as other DNA constituents. ***Carlo Cocito and A. D. Hershey.*** *Biochimica et Biophysica Acta*, v. 37, no. 3, Jan. 29, 1960, p. 543-544.

5075* Neonatal Neutropenia Due to Maternal Isoimmunization. A potent leukoagglutinin was found in the maternal serum which agglutinated leukocytes obtained from the father and all three available children but failed to agglutimate the mother's own cells. Identical leukoagglutinin was found in the last baby's serum; it disappeared after the baby recovered. ***Parviz Lalezari, Murray Nussbaum, Sidney Gelman, and Theodore H. Spaet.*** *Blood*, v. 15, Feb. 1960, p. 236-243.

5076* Autografts of Bone Marrow in Dogs After Lethal Total-Body Radiation. All dogs survived the acute radiation injury. The superior results observed after autologous marrow appear attributable to a rapid postirradiation recovery of lymphoid tissue as well as bone marrow. Circulating lymphocytes reappear, lymph nodes regain normal histologic appearance, and the serum gamma globulin pattern returns to normal. These latter events do not occur promptly after infusions of homologous marrow. ***John A. Mannick, Harry L. Lochte, Jr., Charles A. Ashley, E. Donnall Thomas, and Joseph W. Ferrebee.*** *Blood*, v. 15, Feb. 1960, p. 255-266.

5077* Clinical Studies of 6-Azauracil. Toxicity studies with pyrimidine analog, 6-azauracil, have revealed that the major and perhaps the only adverse effects relate to the central nervous

system. These effects usually manifest themselves initially as lethargy, but may go on to a wide spectrum of sensory and motor abnormalities. Electroencephalographic changes regularly occur, and these often precede the clinical effects. ***Bruce I. Shnider, et al.*** *Cancer Research*, v. 20, no. 1, Jan. 1960, p. 28-33.

5078* Transplantable Human Tumors in Experimental Chemotherapy—A Comparison With Animal Tumor Systems. Nineteen of the 27 compounds originally used in the Investigation of Diverse Systems for Cancer Chemotherapy Screening were tested for anti-tumor activity against the transplantable human tumors H.S. #1 and H.Ep. #3 growing subcutaneously in the conditioned rat. The value of stringent test procedures for preclinical evidence of antineoplastic properties is discussed. ***Morris N. Teller, Philip C. Merker, Joy E. Palm, and George W. Woolley.*** *Cancer Research*, v. 20, no. 1, Jan. 1960, p. 112-119.

5079* Antimicrobial Activity of Vascular Plants. Reports referred to indicate that active substances have been found in plants from 157 families. ***Louis G. Nickell.*** *Economic Botany*, v. 13, Oct.-Dec. 1959, p. 281-318.

5080* The Mast Cells. The investigation of mast cells, heparin, and histamine appear to be about to enter a new phase; the present state of research, and possible lines of progress are described. ***J. F. Riley.*** *Endeavour*, v. 19, no. 73, Jan. 1960, p. 4-8.

5081* Schizophrenia and the Psychotomimetic Drugs. Recent studies of drugs that produce symptoms closely similar to those of schizophrenia have suggested a number of theories concerning the origin of the disease. The research, and the new theories, are discussed in this article. ***J. P. Dewsbery.*** *Endeavour*, v. 19, no. 73, Jan. 1960, p. 20-24.

5082 Fluorine and Dental Health. The Pharmacology and Toxicology of Fluorine. A collection of papers presented at the second symposium on fluoridation of public water supplies and devoted entirely to the physiological and pharmacological aspects of fluoride when used in community water supplies. ***Joseph C. Muhler and Maynard K. Hine, editors.*** 216 pp. 1959. Indiana University Press, Bloomington. (QP981.F55 M89f).

5083* A Simplified Procedure for Purification of Large Amounts of Poliovirus: Characterization and Amino Acid Analysis of Type 1 Poliovirus. ***Leon Levintow and James E. Darnell, Jr.*** *Journal of Biological Chemistry*, v. 235, no. 1, Jan. 1960, p. 70-73.

5084* Biochemical Studies of Lysogeny. ***Roy P. Mackal, Ray Koppelman, Ruth Timmons, and E. A. Evans, Jr.*** *Journal of Biological Chemistry*, v. 235, no. 1, Jan. 1960, p. 175-180.

5085* Suppression of Experimental "Allergic" Encephalomyelitis in Guinea Pigs by Encephalitogenic Proteins Extracted From Homologous Brain. The intradermal injection of aqueous solutions of certain homologous neural proteins will suppress the encephalomyelitis which is induced in guinea pigs by the previous injection of whole homologous brain with Freund's adjuvants. ***Cheng-Mei Shaw, Willson J. Fahlberg, Marian W. Kies, and Ellsworth C. Alvord, Jr.*** *Journal of Experimental Medicine*, v. 111, Feb. 1, 1960, p. 171-180.

5086* The Biological Mechanisms of Air Ion Action. I. 5-Hydroxytryptamine as the Endogenous Mediator of Positive Air Ion Effects on the Mammalian Trachea. Intravenous administration of 5-hydroxytryptamine to rabbits and guinea pigs is shown to bring about changes very similar to those produced by (+) air ions, including decreased ciliary rate, contraction of the posterior tracheal wall, exaggerated response of the tracheal mucosa to trauma, marked vasoconstriction in the tracheal wall, and increased respiratory rate. These effects are reversed by (−) air ions. Reserpine, which depletes 5-hydroxytryptamine in the animal, causes changes that resemble those produced by (−) air ions. ***Albert P. Krueger and Richard F. Smith.*** *Journal of General Physiology*, v. 43, no. 3, Jan. 1960, p. 533-540.

5087* Studies of the Origin of Bacterial Viruses. VI. Effect of Manganese on the Proportion of Phage-Producing, Terramycin-Resistant, Streptomycin-Resistant, and Phage-Resistant Cells in Lysogenic *Megatherium* Cultures. The origin and properties of bacterial viruses may be most simply accounted for by the assumption that they are a specialized type of transforming principle produced as a result of a mutation of the host cell. ***John H. Northrop.*** *Journal of General Physiology*, v. 43, no. 3, Jan. 1960, p. 541-550.

5088* Incorporation of Amino Acids Into Antibody During the Secondary Response. Very little of the antibody formed in the interval between the primary and secondary response was stored to be released during the anamnestic reaction, and the bulk of antibody present in the circulation during the secondary response was formed after the second stimulation with the antigen. ***Maxwell Richter and Felix Haurowitz.*** *Journal of Immunology*, v. 84, no. 2, Feb. 1960, p. 123-127.

5089* An Immunologic and Chemical Study of the Similarities Between Mouse and Human Serum Proteins. ***J. Clausen and J. Heremans.*** *Journal of Immunology*, v. 84, no. 2, Feb. 1960, p. 128-134.

5090* The Effect of the Temperature of Incubation on the Spread of Herpes Simplex Virus in an Immune Environment in Cell Culture. ***M. David Hoggan, Bernard Roizman, and Thomas B. Turner.*** *Journal of Immunology*, v. 84, no. 2, Feb. 1960, p. 152-159.

5091* The Bactericidal Action of Normal Serum and the Properdin System. ***Etsuko Osawa and Louis H. Muschel.*** *Journal of Immunology*, v. 84, no. 2, Feb. 1960, p. 203-212.

5092* Ribonucleoprotein Particles Within Chloromycetin-Inhibited *Escherichia coli*. Cell free extracts of *E. coli* cells exposed to chloromycetin were examined in the analytical ultracentrifuge and compared to control cell extracts. A large new peak (15S) was observed in the chloromycetin cells. It is highly sensitive to ribonuclease, contains 75% ribonucleic acid and 25% protein, and in free electrophoresis has a greater negative charge than normal *E. coli* ribonucleoprotein particles. ***Masayasu Nomura and J. D. Watson.*** *Journal of Molecular Biology*, v. 1, no. 3, Sept. 1959, p. 204-217.

5093* Is the Nucleic Acid Message in a Two-Symbol Code? To account for the diversity of adenine, guanine ratios in the deoxyribonucleic acids (DNA) of various microorganisms, it is proposed that the code in DNA is a two-symbol code. Specifically, it is proposed that the code is a sequence of 6-amino or 6-keto groups and thus adenine is equivalent to cytosine and guanine to thymine (or, in RNA, to uracil). This hypothesis also provides a convenient explanation of the near-equivalence of 6-amino and 6-keto nucleotides in the total RNA of various organisms. ***Robert L. Sinsheimer.*** *Journal of Molecular Biology*, v. 1, no. 3, Sept. 1959, p. 218-220.

5094* Ribonucleoprotein Particles From *Escherchia coli*. In exponential cultures, 25% of the dry weight of *E. coli* is accounted for by RNA. Of this about 80 to 90% is present in ribonucleoprotein particles. Magnesium stabilizes the particles, and on varying its concentration, four kinds of components are observed, with sedimentation constants of 30, 50, 70 and 100S. 70S is formed of one 30S and one 50S; 100S, of two 70S. They all contain about 63% RNA and 37% protein, and have the same density. The molecular weights of the 30S, 50S and 70S particles are about 0.7×10^6, 1.8×10^6, and 2.6×10^6, respectively. ***A. Tissières, J. D. Watson, D. Schlessinger, and B. R. Hollingworth.*** *Journal of Molecular Biology*, v. 1, no. 3, Sept. 1959, p. 221-233.

5095* Nucleotide Composition of Ribonucleoprotein Particles From *Escherichia coli*. The nucleotide composition of the four principal nucleotides is the same in the three different kinds of ribonucleoprotein particles from *E. coli*, with sedimentation constants of 30S, 50S and 70S. ***P. F. Spahr and A. Tissières.*** *Journal of Molecular Biology*, v. 1, no. 3, Sept. 1959, p. 237-239.

5096* Phosphorolysis and Macromolecular Configuration of Biosynthetic Polyribonucleotides and Ribonucleic Acids. (*In French.*) Phosphorolyse et configuration macromoléculaire des polyribonucléotides biosynthétiques et des acides ribonucléiques. ***Marianne Grunberg-Manago.*** *Journal of Molecular Biology*, v. 1, no. 3, Sept. 1959, p. 240-259.

5097* Some Virus Isolations From Common Colds. I. Experiments Employing Human Volunteers. II. Virus Interference in Tissue Cultures. III. Cytopathic Effects in Tissue Cultures. A cytopathic effect was observed in cultures of human and monkey kidney cells inoculated with washings from volunteers with experimental colds and with tissue-culture passage material. This effect was observed best in cultures maintained at 33 C in a medium containing about 0.03% of sodium bicarbonate. I. ***D. A. J. Tyrrell, et al.*** II. ***G. Hitchcock and D. A. J. Tyrrell.*** III. ***D. A. J. Tyrrell and R. Parsons.*** *Lancet*, no. 7118, Jan. 30, 1960, p. 235-242.

5098 Immunity of Mice Surviving Systemic Leukaemia (L1210) to Antifolic Resistant Variants of the Disease. Leukemic mice treated successfully with the dihalogenated derivatives of amethopterin developed immunity to the disease. Chemotherapy may so alter or influence tumor cells that homograft characteristics are acquired or unmasked, thereby facilitating further therapy. ***Abraham Goldin, Stewart R. Humphreys, Gerald O. Chapman, Michael A. Chirigos, and John M. Venditti.*** *Nature*, v. 185, Jan. 23, 1960, p. 219-221.

5099 *In vitro* Cultivation of Blood Cells of *Drosophila melanogaster* in a Synthetic Medium. ***Masakatsu Horikawa and Yukiaki Kuroda.*** *Nature* (Suppl. No. 26), v. 184, Dec. 26, 1959, p. 2017-2018.

5100* Chemical Relief of Insanity. ***H. O. J. Collier.*** *New Scientist*, v. 6, Dec. 31, 1959, p. 1351-1354.

5101* Medicine in the 1960's. A prediction of medical advances likely in the next decade. ***Zenon M. Bacq.*** *New Scientist*, v. 7, Jan. 21, 1960, p. 128-130.

5102* The Influence of Nutrition on Mutation Induced by Radiation. Sixth Douglas Lea Memorial lecture. ***D. G. Catcheside.*** *Physics in Medicine and Biology*, v. 4, no. 2, Oct. 1959, p. 117-125.

5103* Protective Effects on Fecundity and Fertility From Feeding Cysteine and Glutathione to *Habrobracon* Females Before X-Irradiation. ***Daniel S. Grosch.*** *Radiation Research*, v. 12, no. 2, Feb. 1960, p. 146-154.

5104* Late Effects of X-Radiation. The Influence of Dose Fractionation on Life Span, Leukemia, and Nephrosclerosis Incidence in Mice. ***L. J. Cole, P. C. Nowell, and J. S. Arnold.*** *Radiation Research*, v. 12, no. 2, Feb. 1960, p. 173-185.

5105* Serum Enzymes Following Whole-Body Radiation on the Rabbit. Of the fourteen enzymes investigated at least three are significantly lower in the serum of irradiated animals 6 hours after radiation than they are in the sham controls, suggesting either inactivation or interference with synthesis. Four were significantly elevated and seven remained unchanged within an interval of 24 hours after exposure. ***Harry G. Albaum.*** *Radiation Research*, v. 12, no. 2, Feb. 1960, p. 186-194.

5106 Molecular Heterogeneity and Evolution of Enzymes. Describes the molecular heterogeneity of the lactic dehydrogenases obtained from different tissues and from different animals. The data presented indicate that it is possible to classify animals not only by their physiological and morphological characteristics but also by their enzymatic properties, and they also suggest that change in enzyme structure may have been of significance in the establishment of new species. ***Nathan O. Kaplan, Margaret M. Ciotti, Milton Hamolsky, and Robert E. Bieber.*** *Science*, v. 131, Feb. 12, 1960, p. 392-397.

5107* A Serum Cytolytic Factor Active Against HeLa and Other Established Cell Strains. Human serum was shown to contain a cytolytic factor coupled to an inhibitor. The lytic factor could be released by antibody specific to structures on the surface of human tumor cells. This factor could also be dissociated from its inhibitor by dialysis and obtained in a relatively pure state following electrophoresis. It then displayed a lytic effect on four established cell strains of human origin. ***Bertil Björklund.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 103, no. 1, Jan. 1960, p. 1-4.

5108* A Rapid (24 Hour) Bioassay for Detection of Human and Mouse Tumor Factor. An assay system is described for detection, within 24 hours, of tumor factor isolated from mouse and human neoplastic tissues by the BFK technic. ***F. Friedman, R. Kassel, L. Burton, M. L. Kaplan, and A. Rottino.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 103, no. 1, Jan. 1960, p. 16-19.

5109 Differential and Specific Inhibition of ECHO Viruses by Plant Extracts. Comparison of antiviral activity of several plant extracts against several ECHO viruses revealed that M2, prepared from a strain of *Calvatia gigantea* significantly inhibited only ECHO 4 and 11; while M4, a different preparation from the same strain, inhibited only ECHO 7 and 8; and M14, from a species of *Cattleya*, inhibited ECHO 2. The effectiveness of M2 *in vitro* was greatest when the cells were pretreated and when the virus inocula did not exceed 100 tissue culture 50% infectious doses. ***Normand R. Goulet, Kenneth W. Cochran, and Gordon C. Brown.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 103, no. 1, Jan. 1960, p. 96-100.

5110* Rabies Virus Isolated From Brown Fat of Naturally Infected Bats. In each case virus was present in very low infective concentration. Rabies virus was also isolated from brains and salivary glands. ***J. Frederick Bell and G. John Moore.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 103, no. 1, Jan. 1960, p. 140-142.

5111* Familial Primary Amenorrhea Due to Testicular Feminization: A Human Gene Affecting Sex Differentiation. A female patient with "male pseudohermaphroditism with feminizing testes" had a 46/XY chromosomal constitution. Analysis of pedigrees from similar cases demonstrates the causative gene defect to be not strongly linked to either of two sex-linked genes, hemophilia and color blindness. Hence it is probably autosomal. ***Theodore T. Puck, Arthur Robinson, and J. H. Tjio.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 103, no. 1, Jan. 1960, p. 192-196.

5112* Prevention of Experimental Allergic Encephalomyelitis With 6-Mercaptopurine. ***Leon W. Hoyer, Richard M. Condie, and Robert A. Good.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 103, no. 1, Jan. 1960, p. 205-207.

5113* Transplantation of Leukemoid Leukocytes in Irradiated Mice. Cells in the leukocyte fraction of leukemoid blood are capable of transplanting and giving rise to mature erythrocytes of donor type in lethally irradiated mice. ***L. H. Smith, R. A. Popp, and W. St. Amand.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 103, no. 1, Jan. 1960, p. 232-234.

5114* Structure and Synchronized Stretch-Rotation of Hairkeratin Fibres. The theories concerning the stretching of hairkeratin fibers are reviewed. Describes the rotation method and explanation of load-rotation curves in terms of atomic structure is attempted. ***F. Hirsch.*** *Society of Cosmetic Chemists, Journal*, v. 11, no. 1, Jan. 1960, p. 26-37.

5115* Periodicals for Cosmetic Chemists. An analysis of the references cited in the annual reviews of cosmetic chemistry prepared during each of the past three years. ***P. G. I. Lauffer.*** *Society of Cosmetic Chemists, Journal*, v. 11, no. 1, Jan. 1960, p. 49-51.

5116* Transplantation of the V-2 Carcinoma by Suspensions Containing Known Numbers of Tumor Cells. ***Fritz Dixon, Catherine G. Palmer, and M. E. Hodes.*** *Transplantation Bulletin*, v. 7(25), no. 1, Jan. 1960, p. 91-93.

5117 Origin of Life on Earth and Elsewhere. Outlines a possible chain of events leading from the primitive molecules of the primeval earth's atmosphere condensed from space, through the random formation of more or less complex organic molecules, using the available energy sources of ultraviolet light, ionizing radiation or atmospheric electrical discharge, through the selective formation of complex organic molecules via autocatalysis, finally, to the information-transmitting molecule which is capable of self-reproduction and variation. In addition, a system has been evolved in which the concentration of the reaction materials was retained in a relatively small volume of space, leading to the formation of cellular structures. ***Melvin Calvin.*** *U. S. Atomic Energy Commission, UCRL*-9005, Dec. 1959, 44 pp. (UF767 U3u Contin.)

5118* The Control of Cellular Morphology in Embryonic Cells Infected With Rous Sarcoma Virus in Vitro. Different morphological changes are induced in chick fibroblasts *in vitro* by infection with various lines of Rous sarcoma virus. The type of change induced is a genetic character of the virus line. The host cell also plays a role in determining the cellular change, the same virus line producing different effects on different kinds of fibroblasts. ***Howard M. Temin.*** *Virology*, v. 10, no. 2, Feb. 1960, p. 182-197.

5119* The Production and Maintenance of a Virus Carrier State: The Possible Role of Homologous Interference. L cells, exposed to large amounts of heat-inactivated WEE virus, become refractory to destruction by active WEE virus and such cells neither yield virus nor show cytopathic effects. Cultures of cells which have been rendered resistant to infection by treatment with inactive virus may readily become persistently infected with active WEE, and the persistence of this chronically infected state may be due to the continued operation of the interference mechanism. ***Royce Z. Lockart, Jr.*** *Virology*, v. 10, no. 2, Feb. 1960, p. 198-210.

5120* Evidence for Interaction or Genetic Recombination Between Potato Viruses Y and C in Infected Plants. The nature of the interaction between PVC and PVY is unknown, but a likely explanation is that particles are formed that carry genetic determinants from both viruses. ***Marion A. Watson.*** *Virology*, v. 10, no. 2, Feb. 1960, p. 211-232.

5121* Transplacental Transfer of Leukocyte Agglutinins. A mother and child are described whose serum contained leukocyte agglutinins against white cells of the child and of the father with the characteristics of true antibodies. The agglutinins disappeared from the infant's blood at the same rate as transplacentally acquired gamma globulin. The girl's severe neutropenia and resulting poor resistance to infections disappeared simultaneously. ***W. H. Hitzig and R. Gitzelmann.*** *Vox Sanguinis*, v. 4, no. 6, Dec. 1959, p. 445-456.

See also: **5026** (space biology and medicine).

CERAMICS AND CONCRETE

5122 Hot Pressing of Aluminum Oxide. The hot-pressing characteristics of two Al oxides were studied in order to acquire a better understanding of the densification process and to develop a method of predicting the effects of experimental conditions other than those actually tested. A rapid hot-pressing technique was developed which greatly reduced the time element. ***G. E. Mangsen, W. A. Lambertson, and B. Best.*** *American Ceramic Society, Journal*, v. 43, Feb. 1960, p. 55-59.

5123 High-Temperature Reactions of Clay Mineral Mixtures and Their Ceramic Properties: I. Kaolinite-Mica-Quartz Mixtures With 25 Weight % Quartz. The mineralogy and ceramic properties (linear shrinkage and porosity) of fired compacts were studied in relation to composition and firing temperature. A procedure for the quantitative determination of components by X-ray diffraction measurements is outlined and applied to the determination of quartz and mullite in the fired samples. ***G. W. Brindley and S. Udagawa.*** *American Ceramic Society, Journal*, v. 43, Feb. 1960, p. 59-65.

5124 Determination of the Cryolite-Alumina Phase Diagram by Quenching Methods. The phase diagram from 0 to 18.5% alumina was determined. No compounds appeared and no solid solubility was detected on either side of the eutectic. The eutectic point was established at 10.5% alumina at 961 C. ***Perry A. Foster, Jr.*** *American Ceramic Society, Journal*, v. 43, Feb. 1960, p. 66-68.

5125 Cell Dimensions, Solid Solution, Polymorphism, and Identification of Mullite and Sillimanite. X-ray, optical, and chemical data are presented for sillimanites and for a wide range of natural and synthetic mullites. Single-crystal X-ray studies revealed a new type of mullite (called S mullite) characterized by subsidiary sharp reflections in distinction to the extra diffuse reflections of common mullite (called D mullite). ***S. O. Agrell and J. V. Smith.*** *American Ceramic Society, Journal*, v. 43, Feb. 1960, p. 69-76.

5126 High-Temperature X-Ray Diffraction Investigation of the Uranium-Carbon System. The system UC-UC_2 was investigated at temperatures to 2200 C. UC_2, which has the CaC_2 structure, was shown to transform to the CaF_2 structure at 1820 C. Mean coefficients of expansion of UC, U_2C_3, and UC_2 were determined. The decomposition of U_2C_3 to cubic UC_2 and to UC saturated metastably with C was observed. Solubilities of UC in UC_2 and UC_2 in UC were determined near 1800 C by a method based on lattice-parameter measurements. The formation of, and existence conditions for, U_2C_3 were confirmed. It was observed that UC_2 tends to decompose toward UC at the extreme temperatures, probably by loss of C to CO. ***W. B. Wilson.*** *American Ceramic Society, Journal*, v. 43, Feb. 1960, p. 77-81.

5127 Apparatus for Measuring Thermal Conductivity of Ceramic and Metallic Materials to 1200 C. A steady-state apparatus for measuring thermal conductivity by a direct method, viz., water calorimetry, is described. The accuracy of measurement is about 1 to 3% in the temperature range 30 to 300 C and about 3 to 10% in the range 300 to 1200 C. The samples are rods 9 in. long and ¾ in. in diameter, although smaller sizes can be accommodated. One feature of the design is that the sample thermocouples can be plugged into the unit. Curves for samples of alumina, stainless steel, and graphite are included. ***W. H. Sutton.*** *American Ceramic Society, Journal*, v. 43, Feb. 1960, p. 81-86.

5128 Indentation Strength of Glass. The tensile strength of plate and sheet glasses was investigated by means of indentation experiments with small spherical indenters. In agreement with earlier experiments, tensile strengths were observed about 10 to 100 times higher than those found in tensile or bending tests, the highest values being about one-half the greatest strength of thin fibers or freshly drawn rods. ***A. S. Argon, Y. Hori, and E. Orowan.*** *American Ceramic Society, Journal*, v. 43, Feb. 1960, p. 86-96.

5129 Ferroelectric Behavior in Barium Zirconium Metaniobate. An unusual type of ferroelectric behavior was observed in barium zirconium metaniobate, $BaNb_{1.5}Zr_{0.25}O_{5.25}$. The orthorhombic, pseudotetragonal single crystal displays dielectric hysteresis only in its *c* direction, with normal dielectric properties in the *a-b* plane. No evidence of a first- or second-order ferroelectric-paraelectric transition was observed up to 1400 C. ***G. Goodman.*** *American Ceramic Society, Journal*, v. 43, Feb. 1960, p. 105-113.

5130* Effect of Design and Details on Concrete Deterioration. Primarily, deterioration is a result of freezing and thawing. Such deterioration is often thought of as a consequence of the number of times freezing and thawing occurs, but in the examples pictured the major factor is the high degree of saturation which existed at the time of freezing. This high degree of saturation is usually a consequence of inadequate or no drainage provisions at critical points. ***P. D. Miesenhelder.*** *American Concrete Institute, Journal*, v. 31; *ACI Proceedings*, v. 56, no. 7, Jan. 1960, p. 581-590.

5131* Determination of Calcium Sulfoaluminate in Cement Paste by Tracer Technique. To determine the rate of combination of gypsum with aluminate phases during the first few minutes of initial hydration period, a method using radioactive isotope sulfur-35 as a tracer was studied. The method consists of a combination of Forsen's extraction method with an isotope dilution method. ***Toshio Manabe and Naoya Kawada.*** *American Concrete Institute, Journal*, v. 31; *ACI Proceedings*, v. 56, no. 7, Jan. 1960, p. 639-650.

5132 High Temperature Aircraft Windshield Development Program. Fabrication of windshields by the sagging of polished glass to close tolerances using the mold and plunger technique appears very promising. ***A. F. Shoemaker.*** *Corning Glass Works, High Temperature Aircraft Windshield Development Program, Quarterly Report No. 5*, Sept. 1959, 35 pp. (TL681.W5 C81h Contin.)

5133 Glass Bonded Mica. Manufacture and properties of this high-dielectric-strength, low-loss insulating material. ***John E. Faloon.*** *Materials in Design Engineering*, v. 51, Feb. 1960, p. 96-99.

5134 The Chemical Aspects of the Sintering of Aluminum Oxide. Experiments on sintering of Al_2O_3 single crystal spheres in H, He, and O atmospheres between 1500 and 2000 C indicate that the predominant mechanism of material transfer in this process is volume diffusion. The sintering rates in purified dry H were found to be much higher than in O, He, or moist H. Heating in dry H transformed the spheres into polyhedra of hexagonal symmetry. An appreciable loss of oxide due to evaporation of Al_2O and/or AlO was noted. ***G. C. Kuczynski, L. Abernethy, and J. Allan.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 1-12. (TN695 P69p)

5135 An Analytical Testing Method for Proportion of Hardened Concrete. The durability of concrete against freezing and thawing action increases as the water-cement ratio decreases; that of the non-air entrained concrete is remarkably poor in comparison with that of the air entrained concrete. Variation of cement content did not have as much effect on durability as did the variation in the water cement ratio; measurement of expansion of a specimen is an effective means to indicate durability. Even a little entrained air much increased durability; variations in the amount of entrained air changed the durability only slightly. ***Kenji Kosaka and Eisaku Hirano.*** Paper from "Proceedings of the Second Japan Congress on Testing Materials", The Japan Society for Testing Materials, Kyoto, Japan. 1959, p. 147-149. (TA410 J27p2 Over.)

5136* Some Observations on the Mechanical Properties of Ceramic Materials. Analyzes the various factors that influence strength, such as the effects of external stresses due to load and internal stresses caused by heating and cooling, the chemical factors such as the conversion of quartz or fused silica to cristobalite, the reduction of oxidized iron-bearing spinels, the slow and progressive crystallization of a glass bond, the formation of mullite, and the recrystallization of periclase. High temperature and the penetration and reaction of slags also influence strength. ***G. R. Rigby.*** *Refractories Journal*, v. 36, Jan. 1960, p. 2-6.

5137 Gases in Glass. Interaction of H_2O vapor, CO_2, O_2, CO, H_2, N_2 and sulfur oxides with molten glass. Analysis of gases contained in glass. Gases in blisters. ***V. T. Slavyanski.*** *Society of Glass Technology, Journal*, v. 43, Oct. 1959, p. 359T-403T.

5138* A Review of the Production of Molten Zirconia in the Solar Furnace. ***William M. Conn.*** *Solar Energy*, v. 3, no. 3, Oct. 1959, p. 39-42.

See also: **5602** (molten glass, flow of).

CHEMICAL ENGINEERING

5139 Static Testing High-Pressure Piping Components. A method for testing high-pressure piping systems for service in the 20,000 to 40,000-psi range is described. Tubing systems were pressure tested and their behavior followed by means of resistance-wire strain gages mounted on the exterior surface. A method is described for graphically determining the pressure at which a tube wall becomes fully plastic. The allowable working pressure of a tube is determined by applying a safety factor to this pressure. ***T. G. Moore and E. J. Opersteny.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 82, no. 1, Feb. 1960, p. 15-22.

5140 Measurement of the Thermal Conductivities of Gases at High Temperatures. Thermal conductivities of air, A, N, and CO_2 at temperatures up to 900 C, and of steam up to 560 C. Results are compared with values predicted from correlation formulas based on low temperature measurements. ***Robert G. Vines.*** *ASME, Transactions, Series C, Journal of Heat Transfer*, v. 82, no. 1, Feb. 1960, p. 48-52.

5141* Some Physico-Chemical Aspects of Phenolic Preservatives in the Presence of Macromolecules. ***H. B. Kostenbauder.*** *American Perfumer and Aromatics*, v. 75, Jan. 1960, p. 28 + 5 pages.

5142* What the Navy Wants in Fire-Resistant Fluids. Ideal shipboard hydraulic fluid should have nontoxic properties when in enclosed areas for long periods, viscosity index of 150 ± 25 Sayboldt, chemical and thermal stability at 350 F, hydrolytic stability in sea water, low compressibility, low volatility, no objectionable odor, and non-corrosiveness to steel, Cu, and bronze. ***H. F. King and J. A. Coil.*** *Applied Hydraulics & Pneumatics*, v. 13, Feb. 1960, p. 82-84.

5143* A Proposed System for the Continuous Ion-Exchange Separation of Cations. System is analogous to that used in the separation of liquids by fractional distillation for recovering K salts from salt bitterns. ***F. J. Moyle.*** *Australian Journal of Applied Science*, v. 10, no. 4, Dec. 1959, p. 433-448.

5144* On Elasticity Calculations of Three-Dimensional Pipe-Line Systems Which Are Pre-Stressed at Their Flanged End. (*In German.*) Zur Elastizitätsberechnung von Räumlichen Rohrleitungs-systemen, die an ihrem geflanschten Ende vorgespannt werden. ***Johann Hoppe.*** *Brennstoff-Wärme-Kraft*, v. 12, Jan. 1960, p. 15-21.

5145* Swedish Heavy Water Process. Contains an exclusive account of a process which was developed in Sweden for the manufacture of heavy water by the dual-temperature isotope exchange between H_2S and water. ***B. J. Eriksson.*** *Chemical & Process Engineering*, v. 41, Jan. 1960, p. 5-7.

5146* Crystallisation. Advances in knowledge of crystal growth and structure; crystallization in the production of urea and other materials; applications in industry, etc. *Chemical & Process Engineering*, v. 41, Jan. 1960, p. 8-12.

5147* Impulse Rendering. Describes a recent chemical engineering operation that has revolutionized industry in the field of extractive biochemistry by providing a novel means for cellular rupture. ***R. Chayen.*** *Chemical & Process Engineering*, v. 41, Jan. 1960, p. 14-17.

5148* Size Reduction. II. ***R. V. Riley.*** *Chemical & Process Engineering*, v. 41, Jan. 1960, p. 23 + 3 pages.

5149 New Hot-Gas Filters. Plants are improving their hot-gas cleaning operations with bag filters that use glass fabric treated to overcome previous shortcomings. *Chemical Engineering*, v. 67, Jan. 25, 1960, p. 53-54.

5150 How the Air Force Liquefies Hydrogen. Flow sheet of facility for making liquid H for missile fuels. ***R. A. Labine.*** *Chemical Engineering*, v. 67, Jan. 25, 1960, p. 86-89.

5151 Fixed-Bed Adsorption. Improved designs and calculation methods, new materials put adsorption in class technically and economically as distillation, extraction and absorption for the separation of chemicals. ***H. M. Barry.*** *Chemical Engineering*, v. 67, Feb. 8, 1960, p. 105-120.

5152 Nomographs Help Find Tank Diameter. Charts take design pressure into account when determining most economic diameter for vessels up to 35,000 gal. in capacity. ***Leon Green.*** *Chemical Engineering*, v. 67, Feb. 8, 1960, p. 143-144.

5153* Chlorinated Xylenes Show Promising Future. Exhibit ability to contribute useful characteristics to many polymers, and serve as reactive intermediates for dyes, germicides, and pharmaceuticals. ***George F. Rugar.*** *Chemical Processing*, v. 23, Feb. 1960, p. 37 + 2 pages.

5154* Baffle-Plate Controller for Maintaining Constant Flow Volume. A flow controller in which a circular spring-loaded plate orientates itself in a conical tube under the influence of the flow in such a way that it creates the desired pressure less which, by feedback, corrects the throughput to a constant value. *(In German.)* Stauscheibenregler zum Konstanthalten einer Durchflussmenge. ***W. Kast and Th. Gast.*** *Chemie-Ingenieur-Technik*, v. 31, Dec. 1959, p. 796-798.

5155 Work Study in Project Planning of a Chemical Process. I. General Approach and Description. ***H. Birchall.*** *Chemistry & Industry*, 1960, no. 3, Jan. 16, p. 56-59.

5156 Chemistry of Nuclear Power. Fission and the fission products; the new heavy elements; separation processes; water-cooled nuclear reactors; gas-cooled reactor systems and dis-

posal of radioactive wastes. ***J. K. Dawson and G. Long.*** 208 pp. 1959. George Newnes Limited, London. (TK9350 D32s)

5157* Remarks on the Kinetics of Reactions Between Gases With Liquid Catalyst and on the Working of Bubbling Reactors. *(In French.)* Remarques sur la cinétique des réactions entre gaz avec catalyseur liquide et sur le fonctionnement de réacteurs à barbotage. ***A. Bellier.*** *Chimie & Industrie (Génie Chimique)*, v. 82, no. 6, Dec. 1959, p. 158-164.

5158* Capacities and Partially-Filled Volumes of Horizontal Round Tanks and Pipes. A nomograph. ***F. Caplan.*** *Design News*, v. 15, Feb. 1, 1960, p. 32.

5159 Wet Process Phosphoric Acid in Liquid Fertilizers. ***F. M. Batson.*** *Farm Chemicals*, v. 122, Dec. 1959, p. 36-37.

5160* New Chemicals for Weed Control. ***M. W. Meadows.*** *Farm Chemicals*, v. 123, Jan. 1960, p. 48-49.

5161* Efficiency and Guarantee Values in Cracking Installations for Liquid Hydrocarbons. A value factor relative to the upper heating value is assigned to each substance brought in or out or to each energy factor. A balance of the value factors of these substances results in the so-called guarantee value which refers to 1000 Nm^3 of the gas produced. Examples are calculated theoretically for different products used to give the relationship between the guarantee value and the different efficiency definitions. *(In German.)* Wirkungsgrade und Gewährleistungszahl bei Spaltanlagen für flüssige Kohlenwasserstoffe. ***Otto von Neudeck.*** *GWF: Gas- und Wasserfach*, (Gas), v. 101, no. 7, Feb. 12, 1960, p. 149-152.

5162 Nitric Acid Manufacture—Theory and Practice. Describes commercial production and use of nitric acid in the U. S. Several variants of the NH_3 oxidation process are outlined, and the underlying theory of NH_3 oxidation, NO oxidation, and NO_2 absorption in water is summarized. Recent developments include two methods for producing nearly 100% HNO_3 and two methods for direct synthesis of NO. ***H. A. Sorgenti and G. F. Sachsel.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 101-104.

5163 Borane Pilot Plants. Diborane and pentaborane, two high-energy fuels for thrust engines, can be made by controllable, reproducible processes. ***Carlyle S. Herrick, Norman Kirk, Theodore L. Etherington, and A. Eugene Schubert.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 105-112.

5164 The Use of Dual Function Catalysts in Isomerization of High Molecular Weight *n*-Paraffins. ***J. W. Gibson, G. M. Good, and George Holzman.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 113-116.

5165 Catalytic Production of N,N-Dimethylhydrazine. A superior fuel for rocket engine studies was made by the reduction of N-nitrosodimethylamine with gaseous H in presence of Pd. ***Karl Klager, E. Milton Wilson, and George K. Helmkamp.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 119-120.

5166 Processing Low Temperature Lignite Tar. Work on tar derived by the low-temperature carbonization of Sandow, Texas, lignite is described. Separation of the tar into fractions by distillation and studies of the composition of the fractions led to work on separation by means of dual-solvent extraction of the primary tar. A 4-inch-diameter rotating disk contactor was operated to provide information on the effect of operating conditions on yield and quality of the products, as well as to provide material for further characterization studies. A pilot plant capable of processing about 1000 gallons per day is described. ***H. R. Batchelder, R. B. Filbert, Jr., and W. H. Mink.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 131-136.

5167 Solvent Refining of Low Temperature Tar With Paraffinic Solvents. ***M. D. Kulik and M. B. Neuworth.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 141-144.

5168 Batch Fractionation of Coal Tar Naphthalene Oils. ***D. K. H. Briggs, Wright Waddington, and Donald McNeil.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 145-146.

5169 Removal and Recovery of Cesium-137 From Swimming Pool Reactor Water. Use of ethyl alcohol solutions simplifies operations for removing Cs-137 from the waste. ***Fausto W. Lima, Alcídio Abrão, and Constância Pagano.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 147-148.

5170 Water Desalination by Electrodialysis. Clear framework of manageable expressions can be obtained from these conditions and suitable parameters. ***M. v. Ments.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 149-152.

5171 The Mechanism of Catalytic Hydrocracking. Mechanism combines rapid isomerization with cracking and a tendency for hydrogenation to saturate branched olefins. ***R. A. Flinn, O. A. Larson, and Harold Beuther.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 153-156.

5172 Desulfurizing Low Temperature Char. Rate and Total Inhibition Data in Batch Systems. Rate Data in a Continuous System. ***J. D. Batchelor, Everett Gorin, and C. W. Zielke.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 161-168.

5173 How to Calculate Pressure Drop in Spouted Beds. Equations to help develop specialized equipment needed to move fluids through spouted beds. ***Louis A. Madonna and Ricardo F. Lama.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 169-172.

5174 Crystallization. Nucleation and growth; single crystals; zone melting; impurities and additives; bibliography. ***Herbert M. Schoen.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 173-177.

5175 Size Reduction. Improved techniques for agglomeration are among noteworthy developments in size reduction and enlargement. ***Lincoln T. Work.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 178-180.

5176 Ion Exchange Resins as Catalysts. Their function in the hydrolysis of esters; the inversion of sugars; esterification; the formation of acetals; aldol, Knoevenagel, and Michael condensations. ***T. R. E. Kressman.*** *Industrial Chemist*, v. 36, Jan. 1960, p. 3-8.

5177 Modern Methods of Phthalic Anhydride Production. Discusses commercial experience in phthalic anhydride manufacture. ***Peter W. Sherwood.*** *Industrial Chemist*, v. 36, Jan. 1960, p. 21-24.

5178 Industrial Applications of the Metal Organic Compounds. ***J. H. Harwood.*** *Industrial Chemist*, v. 36, Jan. 1960, p. 30-34.

5179 The Vacuum Carbonate and Contact Acid Plants at Beckton. ***L. S. Cooper and R. M. Johnson.*** *Institution of Gas Engineers, Copyright Publication No.* 556, Nov. 1959, 25 pp. (TP700 In7.3c Vis.)

5180 High Temperature Measurement. General methods of high-temperature measurement include thermocouples, total radiation devices, brightness or optical pyrometers, and two-color pyrometers. ***Vincent G. Shaw.*** *Instruments and Control Systems*, v. 33, Jan. 1960, p. 58-61.

5181 Joint Symposium. The Organisation of Chemical Engineering Projects. Concerns the establishment of chemical plant in 14 papers. ***J. M. Pirie, editor.*** 144 pp. 1958. The Institution of Chemical Engineers, London. (TP5 Eu74o Over.)

5182* Composition of Low-Temperature Thermal Extracts From Colorado Oil Shale. ***W. E. Robinson and J. J. Cummins.*** *Journal of Chemical and Engineering Data*, v. 5, no. 1, Jan. 1960, p. 74-80.

5183* Performance of a Pulsed Heat Exchanger. Pulsations which can be used to improve heat transfer coefficients, are discussed in the light of the conflicting recorded data. ***L. K. Doraiswamy and N. B. Patel.*** *Journal of Scientific & Industrial Research*, v. 18A, Nov. 1959, p. 522-526.

5184* New Method for Determining Enthalpy and Entropy of Refrigerants. The identity of the principles of statistical mechanics and phenomenological thermodynamics

was confirmed by the criteria derived herein. *(In Russian.)* Novyĭ metod opredeleniia ental'pīĭ i entropīĭ kholodil'nykh agentov. ***I. Badyl'kes.*** *Kholodil'naia Tekhnika*, v. 36, no. 6, Nov.-Dec. 1959, p. 6-12.

5185 Pump Standardization . . . A User's Concept. A standardized design for a large chemical plant—one size pump meeting requirements for 80% of all the plant's centrifugal pumps. ***R. G. Jobe.*** *Mechanical Engineering*, v. 82, Feb. 1960, p. 57-59.

5186* Vibration Mills and Their Application. Description is given of various types of German vibration mills, with an indication of their grinding capabilities on different materials. ***G. Gerth.*** *Mine & Quarry Engineering*, v. 26, Jan. 1960, p. 30-32.

5187 Characteristics of Coal Preparation Plant Slurries. ***H. B. Charmbury and D. R. Mitchell.*** *Mining Engineering*, v. 12, Jan. 1960, p. 49-52.

5188 Tilt-Fill to Cut Foaming. Adopting a trick that every beer drinker knows, Bristol Myers tips bottles in filler so product flows down inner wall. This technique and all-rotary line increases output of roll-on packaging 150%. *Modern Packaging*, v. 33, no. 6, Feb. 1960, p. 108-111.

5189* How Richfield Reduced Cat Cracker Feed Contamination. Improved fractionation, increased catalyst-addition rate boost throughput and conversion above design capacity. ***E. C. Herthel, E. H. Reynolds, and J. H. Roe.*** *Oil and Gas Journal*, v. 58, no. 5, Feb. 1, 1960, p. 86-89.

5190 Processing Feed Stocks for Cat Cracking. System gives increased production of premium and regular grades of gasoline and of petrochemical raw stock, primarily at the expense of crude oil. ***K. K. McMillin.*** *Oil and Gas Journal*, v. 58, no. 6, Feb. 8, 1960, p. 89-91.

5191 Ozone Chemistry and Technology. Presents sixty papers constituting the Proceedings of the International Ozone Conference held in Chicago, November 1956, covering many facets of the science, technology, and application of this versatile form of O. 465 pp. 1959. American Chemical Society, Washington 69, D. C. (QD181.01 In8o)

5192 Distillation . . . in View of Modern Developments. II. Theory of fractionation; degrees of freedom. ***Kenneth F. Gordon and James A. Davies.*** *Petroleum Engineer*, v. 32, Feb. 1960, p. C31 + 2 pages.

5193 What You Need to Design Thermosiphon Reboilers. Method gives more reliable design; some principles apply to other types of reboilers. ***James R. Fair.*** *Petroleum Refiner*, v. 39, Feb. 1960, p. 105-123.

5194 How to Design Heat Exchanger Piping. Design details for good access, ease of maintenance, and better operation. ***Robert Kern.*** *Petroleum Refiner*, v. 39, Feb. 1960, p. 137-152.

5195* About Centrifugal Pumps. Excessive pump noise, power consumption of boiler feed pump increases as feedwater temperature increases; tools for pump maintenance. ***Igor J. Karassik.*** *Plant*, v. 21, Jan. 1960, p. 42-44.

5196* Exploratory Studies in the Development of Essential Oils and Their Constituents in Aromatic Plants. I. Oil of Agarwood. Essential oils of plant origin occur in the most varied parts of the plants concerned. These volatile oils consist of complex compounds of all classes. Development of highly aromatic agarwood inside the tree of *Aquilaria agallocha* Roxb. (fam. Thymelaeacae), a soft-wooded species growing in the evergreen forests of Assam in India, is regarded as a singularly peculiar pathological formation of the wood tissue. ***Sadgopal.*** *Soap, Perfumery & Cosmetics*, v. 33, Jan. 1960, p. 41-46.

5197 Solar Distillation Experiments at the University of California. A review of work done at the University of California, the projects abroad, and the several reports available on solar distillation, indicates that simple solar distillation is not yet ready for large-scale application. ***Everett D. Howe.*** *Solar Energy*, v. 3, no. 3, Oct. 1959, p. 31-32.

5198* Developments in Desulphurisation. Modified normal H_2S removal by NH_3 washing to adapt it to gases having a high proportion of H_2S. Hot carbonate process costs with hydrocarbon feed stock, the Giammarco-Vetrocoke process, a new desulphurization process by the Atlantic Refining Company, and H_2S removal from natural gas by freezing are discussed. *Sulphur* (Special Issue), 1959, p. 3-13.

5199* Filtration of Sulphuric Acid Mists. Methods of demisting and filter types are discussed. *Sulphur* (Special Issue), 1959, p. 16-19.

5200* Automatic Phosphorus Pentasulphide Manufacture. The modernization of the Oldbury works of Albright & Wilson Ltd. is described. *Sulphur* (Special Issue), 1959, p. 22-23.

5201* Use of Membrane Filter in Microbiological Production Control. The membrane filter method is unsurpassed for enumeration of organisms in liquids where numbers of bacteria are low; it has proved well adapted for the isolation of *Escherichia coli* and *Salmonella* cultivated on diagnostic medium; it can also be used with advantage in isolation and identification of fungi. ***S. Funder.*** *Tidsskrift for Kjemi, Bergvesen og Metallurgi*, v. 19, no. 9, 1959, p. 193-195.

5202 Saline Water Conversion, 1956-58. A Literature Search. ***Frank G. Bennett, IV.*** *U. S. Atomic Energy Commission, NAA-SR-3737*, Jan. 1960, 9 pp. (UF767 Un3.1na Contin.)

5203 Tests of a Mechanical Pipe Joint for Sodium Service. Concludes that the 2-in. units have a good probability of performing satisfactorily in elevated temperature Na service with nominal adjacent pipe wall stresses up to a maximum of 14,000 psi. ***C. Sutherland.*** *U. S. Atomic Energy Commission, NAA-SR-4204*, Jan. 15, 1960, 19 pp. (UF767 Un3.1na Contin.)

5204* Stress on Non-Circular Pressure Vessels. The practical application of several methods suggested for calculating the circumferential tension on noncircular cylindrical vessels, boiler bodies, pipes, tubes and similar hollow bodies under internal or external pressure was used in investigating a cellulose digester. *(In German.)* Beanspruchung unrunder Druckbehälter. ***Kurt Schmidt.*** *VDI Zeitschrift*, v. 102, no. 1, Jan. 1, 1960, p. 11-15.

5205* Petroleum Technology. A study of petroleum covering its origin, characteristics, exploration by indirect detection of naphtha bitumen, drilling and blasting practice, use of atomic energy for the recovery of natural bitumina and other aspects of petroleum production, such as mineral oil from oil shale, underground combustion, formation cleavage, recovery of natural gas, shipment of liquefied natural gas, pipelines, plastic handling containers. (*In German.*) Erdöltechnik. ***Josef Moos.*** *VDI Zeitschrift*, v. 102, no. 1, Jan. 1, 1960, p. 18-31.

5206* Vertical Pumps. II. Deals with wet-pit units of both turbine and propeller (or modified propeller) types. ***Igor J. Karassik.*** *Water & Sewage Works*, v. 107, Jan. 1960, p. 34-37.

5207* Porous Membrane Demineralization. Offers advantages to municipalities with brackish water problems. Nickel alloys employed in equipment manufacture reduces corrosion problems associated with handling saline waters, thus reducing equipment operating costs. *Water & Sewage Works*, v. 107, Feb. 1960, p. 77-79.

5208* A Different Septic Sewage Problem Is Being Attacked by Using Ozone for Sewage Odor Control. Develops an economical method for the production of small quantities of ozone. Its use is quite effective in the control of the odor and corrosion problem resulting from the generation of H_2S. ***W. C. Tims.*** *Water & Sewage Works*, v. 107, Feb. 1960, p. 82.

5209* Producing Equipment for Natural Gas Wells. II. The glycol dehydrator; short cycle hydrocarbon recovery unit; NH_3 absorption refrigeration unit. ***George J. Mapes, R. W. Scott, and J. Roger Heumann.*** *World Oil*, v. 150, Feb. 1960, p. 51-76.

See also: **5414** (nonflammable paint solvents); **5689** (gel development in drilling fluids); **5692** (petroleum technology, review); **5723** (liquid-metal heat exchangers); **6033** (chemical processing economics).

CHEMISTRY—ANALYTICAL

5210 Advanced Analytical Chemistry. Nature of analytical chemistry; ionic equilibria in solutions; potentiometric measurements; measurement of pH; conductometric measurements; polarography and amperometric titrations; electrolytic methods; the absorption of visible and ultraviolet light; absorption of infrared radiation; radiochemical methods; ion-exchange and chromatographic methods; the development of an analytical method. ***Louis Meites and Henry C. Thomas.*** 540 pp. 1958. McGraw-Hill, New York. (QD75 M47a)

5211* Microdetermination of Carbon and Hydrogen in Organic Compounds by Electric Conductivity Measurement. *(In Russian.)* Mikroopredeleniye ugleroda i vodoroda v organicheskikh soyedinenivakh pri pomoshchi izmereniya elektroprovodnosti. ***N. E. Gel'man, M. O. Korshun, Van Ven-iun and N. A. Balashova.*** *Akademiia Nauk SSSR, Doklady,* v. 129, no. 5, 1959, p. 1046-1048.

5212 A Quantitative Study of the Acidity of Certain Hydrocarbons. Mixtures of ethylbenzene-d_5 with two other alkylaromatic hydrocarbons were heated at 150° with potassium metal in sealed ampoules for varying time periods, and the relative rates at which deuterium was transferred to the α-carbon of the two non-deuterated hydrocarbons was measured. ***Harold Hart and Richard Eben Crocker.*** *American Chemical Society, Journal,* v. 82, Jan. 20, 1960, p. 418-422.

5213* Identification of Textile Coatings by Infrared Spectroscopy. ***Florence H. Forziati, Robert T. Hite, and M. Kathryn Wharton.*** *American Dyestuff Reporter,* v. 49, no. 4, Feb. 22, 1960, p. 29-33.

5214* Application of Gas-Liquid Partition Chromatography to the Quantitative Estimation of Monoglycerides. Procedure developed for the quantitative estimation of monoglycerides in terms of their constituent fatty acids. The monoglyceride mixture is mesylated with mesyl chloride in the presence of pyridine, and the resulting dimesyl derivatives are converted to allyl esters of the constituent fatty acids by treatment with NaI in anhydrous acetone at 100 C. The allyl esters are then analyzed quantitatively by gas-liquid partition chromatography at 240 C on a column of Apiezon M-Celite. ***A. G. McInnes, N. H. Tattrie, and M. Kates.*** *American Oil Chemists' Society, Journal,* v. 37, Jan. 1960, p. 7-11.

5215* The Determination of Hexachlorocyclohexane Residues in Foodstuffs. Separation and determination of hexachlorocyclohexane in fats, oils, and vegetables. ***R. Wood.*** *Analyst,* v. 85, Jan. 1960, p. 21-24.

5216* The Determination of Copper and Lead in Indium Arsenide. Determining trace amounts of Cu and Pb in zone-refined InAs by square-wave polarography. ***V. J. Jennings.*** *Analyst,* v. 85, Jan. 1960, p. 62-68.

5217* The Use of Naphthalene Derivatives in Inorganic Analysis. VIII. The Effect of Substituents in the Naphthalene Nucleus on the Fluorimetric Detection of Tin. The intensity of the fluorescence depends markedly upon the electropositivity or electronegativity of the substituent present and the position of the substituent in the naphthalene ring. ***J. R. A. Anderson, J. L. Garnett, and L. C. Lock.*** *Analytica Chimica Acta,* v. 22, no. 1, Jan. 1960, p. 1-7.

5218* A New Cryoscopic Micro-Method for the Determination of Molecular Weights. A method is described for molecular weight determination based on a temperature-heat content curve. The method is applicable even when solute and solvent form mixed crystals. ***W. M. Smit, J. H. Ruyter, and H. F. van Wijk.*** *Analytica Chimica Acta,* v. 22, no. 1, Jan. 1960, p. 8-16.

5219* The Quantitative Analysis of Mixtures of Corrosive Halogen Gases by Gas-Liquid Chromatography. ***J. F. Ellis, C. W. Forrest, and P. L. Allen.*** *Analytica Chimica Acta,* v. 22, no. 1, Jan. 1960, p. 27-33.

5220* Spot Tests for the Identification of Titanium Alloys and Their Differentiation From Zirconium and Its Alloys. ***H. C. J. Saint.*** *Analytica Chimica Acta,* v. 22, no. 1, Jan. 1960, p. 50-55.

5221 Qualitative and Quantitative Analysis of Organic Compounds. Use of Low-Voltage Mass Spectrometry. This method eliminates the necessity of subtracting components from the spectrum of a multicomponent mixture. It provides a rapid means of obtaining the molecular weight and ionization potential of an organic compound. ***Charles J. Varsel, Francis A. Morrell, Frank E. Resnik, and W. Allan Powell.*** *Analytical Chemistry,* v. 32, Feb. 1960, p. 182-186.

5222* The Determination of Molybdenum and Its Application in the Hydrometallurgy of Copper. Molybdenum determination by extraction with chloroform. The resulting complex is analyzed by photometry. ***H. R. Skewes.*** *Australian Journal of Applied Science,* v. 10, no. 4, Dec. 1959, p. 464-469.

5223* The Mass-Spectrometric Analysis of Oxygen in Carbon Monoxide and Carbon Dioxide. Results of measurements of O-18 abundances in CO and CO_2 using a Nier-type isotope-ratio mass spectrometer, are given. ***I. Lauder.*** *Australian Journal of Chemistry,* v. 12, no. 4, Nov. 1959, p. 630-636.

5224* A Method for the Determination of the Structure of Saturated Branched-Chain Fatty Acids. The C chain of methyl-branched acids can be readily degraded by $KMnO_4$ in acetone, to give a series of acids of decreasing C number. Where a branch occurs, the acid series is interrupted and a methyl ketone of the same C number as a missing acid is produced. Gas chromatographic examination of the ketone(s) and esterified acids gives clear evidence for the location of the branch(es). ***K. E. Murray.*** *Australian Journal of Chemistry,* v. 12, no. 4, Nov. 1959, p. 657-670.

5225* Photometric Determination of Potassium Using Dipicrylamine (Hexanitrodiphenylamine). Diphenylamine served as the initial substance and was changed into dipicrylamine by nitration. The preparation of potassium dipicrylaminate, its absorption and solubility in water, its testing on the basis of the Lambert-Beer law, the determination of the empirical calculation factor by precipitation tests, the modulus of molar extinction and the functional relationship between extinction and the pH value, concentration, and time were studied. *(In German.)* Photometrische Bestimmung von Kalium mit Dipikrylamin (Hexanitrodiphenylamin). ***Konrad Riedler and Ludwig Schreiner.*** *Chemische Technik,* v. 11, no. 11, Nov. 1959, p. 593-595.

5226* Polarography and Its Industrial Applications. A brief introduction to polarography. ***D. G. Anderson.*** *Control,* v. 2, no. 14, Aug. 1959, p. 80-85.

5227 XV International Congress of Pure and Applied Chemistry (Analytical Chemistry), Proceedings, 1956. Articles in various languages contain analytical determinations and new methods of analysis. Fluorometry, phosphorimetry, spectrophotometry, and flame photometry are discussed. XV Congresso Internacional de Química Pura e Aplicada (Química Analitica), Actas do Congresso, 1956. v. II. 1958, 1046 pp. Lisbon. (QD1 In8p)

5228 The Determination of the Branching Degree in Natural and Artificial Hydrocarbon Mixtures by Means of the Ultrasonic Velocity. The ultrasonic velocity is determined with great accuracy by the optical method. Application of the method is made in natural and artificial hydrocarbon mixtures containing branched and unbranched paraffins, naphthenes, and aromatics. Limits of the applicability of the method are discussed. ***M. Baccaredda and E. Butta.*** Paper from "XV International Congress of Pure and Applied Chemistry (Analytical Chemistry), Proceedings, 1956", v. II. Lisbon. 1958, p. 29-38. (QD1 In8p)

5229 Flame Photometric Determination of Sulfate Ion. The possibilities of the indirect determination by flame photometry of sulfate ions, by difference, using Ba and Sr as background elements, at constant concentration are discussed. ***F. Burriel-Marti, J. Ramirez-Muñoz, and M. L. Rexach-M. De Lizarduy.*** Paper from "XV International Congress of Pure and Applied Chemistry (Analytical Chemistry), Proceedings, 1956", v. II. Lisbon. 1958, p. 70-110. (QD1 In8p)

5230 The Fluorometric Determination of 2,8; 2,7; 2,6; 2,5 Isomers of Naphthylamine-Monosulfonic Acids. The isomers of the 2-naphthylamine-monosulfonic acids are determined in binary mixtures either by their total fluorescence at constant pH or by quenching of the fluorescence of one of the isomers by adding $Al(NO_3)_3$ and measurement of the residual fluorescence. ***F. Čůta and J. Borecký.*** Paper from "XV International Congress of Pure and Applied Chemistry (Analytical Chemistry), Proceedings, 1956", v. II. Lisbon. 1958, p. 208-217. (QD1 In8p)

5231 A New Reagent for the Colorimetric and Spectrophotometric Determination of Phosphorus, Arsenic and Germanium. The absorption spectra, the influence of temperature, time, quantity of reagent, and selectivity of method are studied. ***F. Lucena Conde and L. Prat.*** Paper from "XV International Congress of Pure and Applied Chemistry (Analytical Chemistry), Proceedings, 1956", v. II. Lisbon. 1958, p. 305-312. (QD1 In8p)

5232 Determination of the Mineral Constituents and of the Analytic Composition of Mineral Mixtures by Means of Combined X-Ray Diffraction and X-Ray Spectrography. With the help of some analyses of mineral mixtures it was shown that an X-ray interference goniometer can be used advantageously for the determination of the mineral constituents, and of the amount of elements having an atomic number higher than about 20. The instrument used could be converted into a spectrometer with little manipulation involved. It could further be used as a counter tube interference goniometer for recording the diffraction diagram to identify the minerals. It was possible to obtain a quantitative determination with a 1% accuracy. This method is much shorter than usual methods, especially for the determination of Nb, Ta, Zr, Hf, U, W, Mo, and rare earths. (*In German.*) Die Bestimmung des Mineralbestandes und der analytischen Zusammensetzung von Mineralgemischen durch kombinierte Röntgen-Beugung und Röntgenspektrographie. ***W. Miedreich.*** Paper from "XV International Congress of Pure and Applied Chemistry (Analytical Chemistry), Proceedings, 1956", v. II. Lisbon. 1958, p. 322. (QD1 In8p)

5233 The Determination of Vitamin D and Related Compounds. Descriptions are given of the preparation, mainly by chromatographic methods, of compounds closely related to the vitamins D. The mixture of compounds formed during the irradiation of the provitamins D may be separated into two main groups by chromatography; individual compounds may then be determined in each group by ultra-violet absorption and colorimetric methods. ***W. H. C. Shaw, J. P. Jefferies, and T. E. Holt.*** Paper from "XV International Congress of Pure and Applied Chemistry (Analytical Chemistry), Proceedings, 1956", v. II. Lisbon. 1958, p. 379-402. (QD1 In8p)

5234 Contribution and Future Possibilities of Infrared Spectrometry in the Characterization of Plastic Materials. (*In French.*) Apports et perspectives de la spectrometrie infrarouge dans la caracterisation des matieres plastiques. ***P. Dubois, L. Jacqué, and J. Henniker.*** Paper from "XV International Congress of Pure and Applied Chemistry (Analytical Chemistry), Proceedings, 1956", v. II, Lisbon. 1958, p. 549-555. (QD1 In8p)

5235* The Isotopes Dilution Method and Its Application to Analysis of Inorganic Substances. General principles of isotope dilution with radioactive and stable tracers are considered. The importance of the purity of recovered substances and the dependence of accuracy on various factors are discussed. ***I. P. Alimarin and G. N. Bilimovitch.*** *International Journal of Applied Radiation and Isotopes,* v. 7, no. 3, Jan. 1960, p. 169-181.

5236 Method for Determining the Area of Spots in Paper Chromatography. Method uses photography to provide a simple, objective way of measuring the area of a spot in a paper chromatogram. ***J. S. Knypl and R. Antoszewski.*** *Journal of Chemical Education,* v. 37, Jan. 1960, p. 49.

5237 The Determination of Sulphur in Cast Iron. A Study of the Combustion Method With an Assessment of the Value of Vanadium Pentoxide as Flux. Results of an investigation into the possible sources of loss and the effect of using fluxes, in particular vanadium pentoxide. Concludes that to obtain anything approaching stoichiometric recovery it is necessary to find some means of retaining the sulphur trioxide formed and to complete the determination by an alkali titration. ***H. Green.*** *Metallurgia,* v. 60, Nov. 1959, p. 229-232.

5238* Ultramicro Determination of Iodine in Drinking Water on the Basis of Feigl's Catalytic Reaction. The determination of 0.025-0.2μg iodide-iodine in 14 ml volume. ***Ervin Jungreis and Itzhak Gedalia.*** *Mikrochimica Acta,* 1960, no. 1, p. 145-149.

5239* A New Simple Nitrometer for Dumas Nitrogen Determination. The nitrometer has a stop valve of Daiflone (difluoroethylene polymer) replacing the top stopcock used in the conventional nitrometer. The volume of nitrogen in the nitrometer can be measured directly without a leveling operation and reduction to the volume under atmospheric pressure is carried out by using a correction curve. ***Tetsuo Mitsui.*** *Mikrochimica Acta,* 1960, no. 1, p. 150-156.

5240* Determination of Water in Alcohol. Uncomplicated procedure for detection and determination of water in alcohol used for the deep-etch process, for use in the litho shop by personnel who have little or no chemical knowledge. No elaborate, costly instruments necessary. ***Robert F. Leonard.*** *Modern Lithography,* v. 28, Jan. 1960, p. 53 + 2 pages.

5241 Comparison of Efficiency and Separating Power of Packed and Capillary Gas Chromatographic Columns. *J. H. Purnell.* *Nature* (Suppl. no. 26), v. 184, Dec. 26, 1959, p. 2009.

5242* Rapid Complexometric Determination of Cobalt in Hard Metals. Exhibiting a very high accuracy and requiring only little time, this method represents an excellent routine-type analysis. The maximum relative error is approximately 0.5%; the analysis can be easily performed in 20 minutes. (*In German.*) Zur komplexometrischen Schnellbestimmung des Kobaltgehaltes von Hartmetallen. ***E. Lassner and R. Scharf.*** *Planseeberichte für Pulvermetallurgie,* v. 7, no. 3, Dec. 1959, p. 129-131.

5243 Qualitative Analysis and Electrolytic Solutions. Textbook discusses the topics solutes and solutions, ionic reactions and equations, concentration of substances in solution, reaction rates, precipitates and colloids, acids and bases, indicators, electric cells, and laboratory qualitative analysis methods. ***Edward J. King.*** 641 pp. 1959. Harcourt, Brace and Co., New York. (QD81 K58q)

5244* Critical Study of the Determination of Hydrogen in Steel. Introduces a new apparatus equipped with a Pd filter for separating the H from the accompanying impurities within the extraction time during the degassing of a steel specimen held *in vacuo* at constant temperature. The release of H_2 from a specimen held *in vacuo* at 600 C follows the exponential law. (*In French.*) Étude critique du dosage de l'hydrogène dans l'acier. ***J. Calmettes, Ch. Dubois, and P. Bastien.*** *Revue de Métallurgie, Mémoires Scientifiques,* v. 56, no. 7, Dec. 1959, p. 641-656.

5245* Analysis of Rubber. The identification and determination of natural and synthetic rubbers. ***V. L. Burger.*** *Rubber Chemistry and Technology,* v. 32, no. 5, Dec. 1959, p. 1452-1474.

5246* Analysis of Phenols by Chromatography in the Gaseous Phase. A large number of simple C_6 to C_9 phenols were analyzed. A closer investigation was conducted in the case of xylenols in order to interpret the effect of alkyls on the volumes of retention and their relationship with the constitution of this phenol family. The volume of retention of some phenols has been anticipated by means of the order of elution. Phenolic fractions of coal hydrogenates have been quantitatively analyzed. (*In French.*) Analyse des phénols par chromato-

graphie en phase gazeuse. ***Alfred Kreyenbuhl and Henri Weiss.*** *Société Chimique de France, Bulletin,* 1959, no. 11-12, Nov.-Dec., p. 1880-1885.

5247* A New Photometric Determination of Cerium With Methylene Blue. ***Hidehiro Gotô and Yachiyo Kakita.*** *Tohoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy,* v. 2, no. 6, Dec. 1959, p. 442-450.

5248 Perarylated Silanes. Identification by X-Ray Diffraction Powder Patterns. X-ray powder diffraction data for 20 arylsilanes in various forms of graphic presentation for ease in identification, characterization, and analysis. These include the actual pictorial diffraction patterns, extended listings of d-spacings with relative intensities, and a Hanawalt-type index identifying the catalogued compounds by means of all combinations of the three most intense lines. ***Frank L. Chan and Leonard Spialter.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-512, 30 pp. (TL507 Un3.18w Vis.)

5249 The Determination of Chlorine in Polyurethane Plastic. The sample is burned in a special combustion tube with two O_2 inlets, the products of combustion are absorbed in a solution containing NaOH and H_2O_2, and the chlorine is measured either gravimetrically as AgCl or spectrophotometrically, using mercuric thiocyanate and ferric perchlorate. Eighteen determinations of chlorine in known solutions of sodium chloroacetate or perchloric acid gave an average recovery of 98.3% with a standard deviation of 2.8%. ***A. L. Henicksman, E. H. VanKooten, R. D. Gardner, and W. H. Ashley.*** *U. S. Atomic Energy Commission, LA-2362,* Oct. 1959, 11 pp. (UF767 U3La Contin.)

5250 Fluorescent X-Ray Spectrographic Analysis: Studies of Low-Enregy K, L, and M Spectral Lines. ***William J. Campbell.*** *U. S. Bureau of Mines Report of Investigations* 5538, 1959, 20 pp. (Tn21 Un3r Vis.)

5251* Black Titration With Mercuric Nitrate in Alkaline Medium. Estimation of Small Amounts of Lanthanum and Analysis of Its Binary Mixtures With Some Other Metals. Lanthanum in the order of 50 μg up to 60 mg was determined with high accuracy in most cases. The method is further successfully applied for analysis of pairs of La with Th, Ba, Hg^{II}, Mn^{II}, Cu, Zn, Cd, Ni, Co, or Bi using a suitable precipitant or masking agent or selective pH. NH_4F has proved to be a suitable masking agent for small amounts of La. ***H. Khalifa, M. Hamdy, and A. Soliman.*** *Zeitschrift für Analytische Chemie,* v. 171, no. 3, 1959, p. 178-185.

5252* Rapid Extraction of Copper(II) With 2-Thenoyltrifluoroacetone Direct Colorimetric Determination in the Organic Phase. Copper(II) is extracted quantitatively from an aqueous solution by TTA-benzene in a single extraction. The green-colored copper(II)-TTA chelate solution in benzene obeys Beer's law at 430 mμ over the range of 16-180 μg Cu per ml. Method is reproductible to within ± 1.4%. ***Shripad M. Khopkar and Anil K. De.*** *Zeitschrift für Analytische Chemie,* v. 171, no. 4, 1959, p. 241-246.

5253* On the Hydroxyl Groups on the Surface of the Amorphous Silica "Aerosil" and Their Reactions. The hydroxyl groups react with $Ca(OH)_2$; esters are formed by reaction with alcohols and diazomethane. Heating with thionyl chloride leads to substitution by chlorine. This reaction is especially suited for the quantitative determination of hydroxyl groups bound to silica surfaces. With lithium phenyl, chlorine bonded to surface Si atoms can be substituted by phenyl groups. (*In German.*) Über die Hydroxylgruppen an der Oberfläche des amorphen Silicium-dioxyds "Aerosil" und ihre Reaktionen. ***H.-P. Boehm and M. Schneider.*** *Zeitschrift für Anorganische und Allgemeine Chemie,* v. 301, no. 5-6, Oct. 1959, p. 326-335.

5254* Radiochemical Investigations of the Partial Processes of Barium Sulfate Precipitation. I. Description of the Method and Experimental Part. II. Discussion and Results. (*In German.*) Radiochemische Untersuchungen über die Teilvorgänge der Bariumsulfatfällung. I. Beschreibung der Methode und experimenteller Teil. II. Diskussion der Messergebnisse. ***K. H. Lieser and A. Fabrikanos.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 22, nos. 3-4, Nov. 1959, p. 246-291.

See also: **5131** (determination of calcium sulfoaluminate in cement); **5137** (determination of gases in glass); **5400** (analysis of coating materials); **5633** (Mn in gasolines); **5756** (differential thermal analysis apparatus).

CHEMISTRY—INORGANIC AND GENERAL

5255* Viscosity of Liquid Hydrogen Sulphide. The viscosity of liquid H_2S was measured under the pressure of its saturated vapor in the temperature region from 11.5 to 50 C. A closed type, pressure resistant Ostwald viscometer was used. ***J. W. Hennel and K. Krynicki.*** *Acta Physica Polonica,* v. 18, no. 5, 1959, p. 523-526.

5256 Preparation of Silyl- and Germylmetallic Compounds. Triphenylsilyllithium was prepared by the reaction of chlorotriphenylsilane and Li in solvents like tetrahydrofuran, 2-methyltetrahydrofuran, and tetrahydropyran. Similarly, dimethylphenylsilyllithium, triphenylsilylpotassium, triphenylsilylrubidium, triphenylsilylcesium, tri-*o*-tolylsilyllithium, and tri-*o*-tolylsilylcesium were prepared by the treatment of the respective chlorosilanes with corresponding alkali metals. ***M. V. George, Donald J. Peterson, and Henry Gilman.*** *American Chemical Society, Journal,* v. 82, Jan. 20, 1960, p. 403-406.

5257* "Donomen"—A New Nomenclature System for Chemicals and Pharmaceuticals. A method whereby ten million new names could be easily coined to cope with the output of new chemicals. ***E. C. S. Little.*** *American Perfumer and Aromatics,* v. 75, Feb. 1960, p. 34 + 2 pages.

5258 Peroxides of Elements Other Than Carbon. VI. Peroxides of Germanium. Preparation by treating alkylgermanium halides or germanium tetrachloride with alkyl hydroperoxides or H_2O_2 in the presence of a base under anhydrous conditions. ***Alwyn G. Davies and C. D. Hall.*** *Chemical Society, Journal,* 1959, Dec., p. 3835-3838.

5259 Chemical Society Symposia, Bristol 1958. A collection of papers divided into three sections: developments in aromatic chemistry, applications of electron and nuclear resonance in chemistry, and recent work on the inorganic chemistry of sulfur. 401 pp. 1958. The Chemical Society, Burlington House, London. (QD331 C42c)

5260 The Intermediate Oxides of Lead. A discussion of the oxidation of lead monoxide, the decomposition of lead dioxide, the range of stoichiometric composition of the intermediate phases, and their inter-convertibility. ***J. S. Anderson and M. Sterns.*** *Journal of Inorganic and Nuclear Chemistry,* v. 11, no. 4, Dec. 1959, p. 272-285.

5261 Studies on Hydrated Ceric Oxide. The structure is studied by X-ray diffraction and infrared spectra. The stability of ceric hydroxide at high temperatures is disproved. ***S. S. Moosath.*** *Journal of Inorganic and Nuclear Chemistry,* v. 11, no. 4, Dec. 1959, p. 286-289.

5262 The Silver-Catalysed Reduction of Persulphate by Oxalate in Acid Solution. The energy and entropy of activation for the reduction were calculated, a probable mechanism suggested, and the reaction inhibitors given. ***Y. K. Gupta and S. Ghosh.*** *Journal of Inorganic and Nuclear Chemistry,* v. 11, no. 4, Dec. 1959, p. 320-328.

5263 Sodium Ozonide. Sodium ozonide is studied by the visible spectra with ammonia as the solvent. A soluble sodium ozonide is formed easily at −60 C and is stable at that temperature. ***I. J. Solomon and A. J. Kacmarek.*** *Journal of Physical Chemistry,* v. 64, Jan. 1960, p. 168-169.

5264* A Study of Rhodium(III) Oxalates by Paper Electrophoresis, Paper Chromatography, Ion-Exchange Chromatography and Spectrophotometry. To obtain complete conversion of rhodium(III) into potassium rhodiotrioxalate the chloride must be heated under reflux with four-to-five times its

weight of potassium oxalate for at least six hours. ***S. K. Shukla.*** *Journal of the Less-Common Metals*, v. 1, no. 5, Oct. 1959, p. 333-342.

5265 A Higher Hydrogen Peroxide, H_2O_4? An experimental procedure is reported which confirms the presence of a higher H superoxide reported by other scientists. ***J. G. Marshall and P. V. Rutledge.*** *Nature* (Suppl. No. 26), v. 184, Dec. 26, 1959, p. 2013-2014.

5266* On Peroxy-Antimonates. Solutions of antimonates give peroxy-antimonates with H_2O_2. These are amorphous, polymeric, insoluble substances. The approximate composition of some of these compounds is $KSbO_4 \cdot 1.7\ H_2O$, $NaSbO_4 \cdot 2\ H_2O$, $KSbO_4 \cdot 1.8\ H_2O_2$ and $K_2HSb_3O_{12} \cdot 3.5\ H_2O$. The constitution of the peroxy-antimonates is discussed with help of their infrared spectra. *(In German.)* Über Peroxyantimonate. ***Hans Siebert.*** *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 301, no. 5-6, Oct. 1959, p. 316-322.

See also: **5191** (ozone chemistry).

CHEMISTRY—ORGANIC

5267* Chloromethylation of Arylaliphatic Disiloxanes. Synthesis of Chloromethylbenzyldimethylchlorosilane and Its Derivatives. *(In Russian.)* Reaktsiia khlormetilirovaniia arilalifaticheskikh disiloksanov. Sintez hklormetilbenzildimetilkhlorsilana i ego proizvodnykh. ***K. A. Andrianov, A. A. Zhdanov, and V. A. Odinets.*** *Akademiia Nauk SSSR, Doklady*, v. 130, no. 1, Jan.-Feb. 1960, p. 75-78.

5268* The Synthesis and Catalytic Hydrogenation of Diphenylcyclopropanes. *(In Russian.)* Sintez i kataliticheskoe gidrirovanie difeniltsiklopropanov. ***B. A. Kazanskii, M. Iu. Lukina, and I. L. Safonova.*** *Akademiia Nauk SSSR, Doklady*, v. 130, no. 2, Jan. 11, 1960, p. 322-324.

5269* On Acid Amides of Phosphorus. Infrared Absorption Spectra of Imido-Phosphates and Imido-Phosphinates. *(In Russian.)* Ob imidakn kislot fosfora infakrasye spektry pogloshenyia imidofosfatov i imidofosfinatov. ***M. I. Kabachnik, V. A. Gilyarov, and E. N. Tsvetkov.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1959, no. 12, Dec., p. 2135-2141.

5270 Organoboron Compounds. XII. Identification of the Presumed Alkoxydifluoroboranes as Coördination Compounds of Trialkyl Borates and Boron Fluoride. A consideration of vapor densities, cryoscopic molecular weights, distillation behavior, electric moments, and reaction with N bases leads to the identification of the presumed alkoxydifluoroboranes as coördination compounds of trialkyl borates and two moles of boron fluoride. ***Patrick A. McCusker and S. M. Laeticia Kilzer.*** *American Chemical Society, Journal*, v. 82, Jan. 20, 1960, p. 372-375.

5271 Synthesis of Potential Anticancer Agents. XX. 2-Fluoropurines. The 2-fluoro derivatives of a number of biologically active purines were prepared from the corresponding 2-aminopurines by a modified Schiemann reaction. Properties are discussed. ***John A. Montgomery and Kathleen Hewson.*** *American Chemical Society, Journal*, v. 82, Jan. 20, 1960, p. 463-468.

5272 The Synthesis of Nitrogen-containing Ketones. VIII. The Acylation of 3-Picoline, 4-Picoline and Certain of Their Derivatives. Side-chain acylation gave high yields of the corresponding ketones containing pyridine rings. For the first time it was possible to effect the direct acylation of 3-picoline with aliphatic esters to give alkyl 3-picolyl ketones using sodium diisopropylamide as the condensing agent. ***Stuart Raynolds and Robert Levine.*** *American Chemical Society, Journal*, v. 82, Jan. 20, 1960, p. 472-475.

5273* The Synthesis and Properties of Mercaptans Having Different Degrees of Acidity of the Sulfhydral Group. ***J. W. Haefele and R. W. Broge.*** *American Perfumer and Aromatics*, v. 75, Jan. 1960, p. 39 + 11 pages.

5274* Acetylene Studies. XIV. Action of Nitryl Chloride on Acetylene Compounds. The reactions of NO_2Cl with four dissubstituted acetylenes $R \cdot C{:}C \cdot R'$ differ according to the constitution of R and R'. *(In German.)* Untersuchungen über Acetylene. XIV. Die Einwirkung von Nitrylchlorid auf Acetylenverbindungen. ***Hans Heinrich Schlubach and Arthur Braun.*** *Annalen der Chemie (Justus Liebigs)*, v. 627, nos. 1-3, 1959, p. 28-34.

5275* Base-Catalyzed Dehydration. II. Concerning a New Method to Prepare Cyclic 1.3-Diene. Hydroxymethyl compounds of methylcyclohexene and of methylcyclohexane can be dehydrated by base catalysis. This is a simple method to prepare very hard to obtain *o*-dimethylene-cyclohexanes and methylene cyclohexenes. The mechanism of the dehydration by catalysis exchange of $\alpha\beta$-and $\beta\gamma$-unsaturated primary alcohols is discussed. *(In German.)* Zur basenkatalysierten Dehydratisierung. II. Über eine neue Methode zur Darstellung cyclischer 1.3-Diene. ***Günther Ohloff.*** *Annalen der Chemie (Justus Liebigs)*, v. 627, nos. 1-3, 1959, p. 79-95.

5276* Acid-Catalyzed Self- and Mixed Condensations With Formaldehyde and Isobutyraldehyde. Synthesis of Tricyclic Acetals. With the help of formaldehyde/isobutyraldehyde, it is shown that during the acid-catalyzed aldol reaction which, in synthetic effect, corresponds to the base-catalyzed reaction, tricyclic acetals with the ring system of the 2,6,10,14,17,18 hexaoxa-tricyclo-[11,3,1,$1^{5,9}$]-octadecane. During the self-condensation of the formaldehyde in glacial acetic acid/sulfuric acid, acetylglycol acid is formed. *(In German.)* Über säurekatalysierte Selbst- und Mischkondensationen mit Formaldehyd und Isobutyraldehyd. Die Synthese Tricyclischer Acetale. ***Sigurd Olsen, Erik Aalrust, Arne Henriksen, and Bodil Alstad.*** *Annalen der Chemie (Justus Liebigs)*, v. 627, nos. 1-3, 1959, p. 96-106.

5277* Azocoupling of Pyrrole- and Cyanin Dyes. Polymethine dyes, conceived as higher aromatic systems, couple in electrophilic reaction in the polymethine chain with diazonium salts. Porphyrins react with diazonium salts with a marked modification of the dye character. *(In German.)* Azokupplung von Pyrrol- und Cyaninfarbstoffen. ***Alfred Treibs and Roswitha Zimmer-Galler.*** *Annalen der Chemie (Justus Liebigs)*, v. 627, nos. 1-3, 1959, p. 166-181.

5278* The Preparation of the Esters of Some Substituted Sebacic Acids From Oleic Acid. ***L. K. Dalton, H. H. Hatt, and A. Z. Szumer.*** *Australian Journal of Chemistry*, v. 12, no. 4, Nov. 1959, p. 671-677.

5279 The Chemistry of Ninhydrin. Synthesis, properties, reactions, and analytical uses of ninhydrin. ***D. J. McCaldin.*** *Chemical Reviews*, v. 60, no. 1, Feb. 1960, p. 39-51.

5280 The Structure and Properties of Certain Polycyclic Indolo- and Quinolino-Derivatives. XIII. The Cyclisation of Certain 4-Pyridyl- and 4-Quinolyl-hydrazones. The final stage in the improved preparation of 4-pyridyl- and 4-quinolylhydrazine is discussed. ***Frederick G. Mann, A. F. Prior, and Trevor J. Willcox.*** *Chemical Society, Journal*, 1959, Dec., p. 3830-3834.

5281 The Thermal Isomerization of 1,1-Dimethylcyclopropane. The main products of the isomerization are 3-methylbut-1-ene and 2-methylbut-2-ene. ***M. C. Flowers and H. M. Frey.*** *Chemical Society, Journal*, 1959, Dec., p. 3953-3957.

5282 Syntheses of 1-Phenylfluorene and 1- and 3-Phenylphenanthrene. The ultraviolet spectra of these and related compounds are discussed. ***D. M. W. Anderson, Neil Campbell, D. Leaver, and W. H. Stafford.*** *Chemical Society, Journal*, 1959. Dec., p. 3992-3997.

5283 Aliphatic Friedel-Crafts Reactions. II. The Acylation of Cyclopentene. ***N. Jones and H. T. Taylor.*** *Chemical Society, Journal*, 1959, Dec., p. 4017-4019.

5284 The Oxidation of Diphenylmethylenecyclobutane. ***S. H. Graham and A. J. S. Williams.*** *Chemical Society, Journal*, 1959, Dec., p. 4066-4073.

5285 Tautomerism of *N*-Heteroaromatic Aldoximes. In aqueous solution, a small amount of the zwitterionic N-H tautomer co-exists with the predominant enol form, and tauto-

meric equilibrium constants have been calculated from both the ionization constants and the spectroscopic data. ***S. F. Mason.*** *Chemical Society, Journal,* 1960, Jan., p. 22-26.

5286 A New Chromone Synthesis. Reduction of *NN*-dimethylaniline and of *NN*-dimethyl-*p*-toluidine by Na and alcohol in liquid ammonia afford the 2,3-dihydro-amines as main products. ***B. B. Millward.*** *Chemical Society, Journal,* 1960, Jan., p. 26-30.

5287 Diboron Tetrachloride-Olefin Compounds. I. Some Properties of Diboron Tetrachloride-Ethylene. A study of the reactions involving diboron tetrachloride-ethylene. ***A. K. Holliday and A. G. Massey.*** *Chemical Society, Journal,* 1960, Jan., p. 43-46.

5288 The Basic Properites, Infrared Spectra, and Structures of Triphenylamine and Tri-p-tolylamine. From a consideration of the infrared spectra of triphenylamine and tri-*p*-tolylamine it is considered that there is a planar or almost planar arrangement about the central N atom in these molecules. ***R. D. W. Kemmitt, R. H. Nuttall, and D. W. A. Sharp.*** *Chemical Society, Journal,* 1960, Jan., p. 46-50.

5289 Synthetical Studies of Terpenoids. III. Syntheses of Azulene Derivatives. IV. Syntheses of Decalin Derivatives. Isomeric dimethylbicyclo[5,3,0]decen-2-ones, expected to be useful intermediates in the synthesis of guaianolides, were prepared. Synthesis of an acetoxytetramethyldecalone and its stereochemistry are reported. III. ***J. R. Mahajan and Phanindra Chandra Dutta.*** IV. ***Soumyendra Lal Mukherjee and Phanindra Chandra Dutta.*** *Chemical Society, Journal,* 1960, Jan., p. 62-71.

5290 Reactions of Aryl Radicals With Aliphatic Compounds. I. The Reactions of Phenyl Radicals With Carbon Tetrachloride, Chloroform, and Bromoform. II. The Reactions of Phenyl Radicals With Some Esters. The main products formed in the reactions were determined quantitatively. ***D. H. Hey and J. Peters.*** *Chemical Society, Journal,* 1960, Jan., p. 79-96.

5291 Pyrrolo[2,3-*d*]pyrimidines. Pyrrolo[2,3-*d*]pyrimidines have been obtained by spontaneous cyclization of 4-aminopyrimidyl-acetaldehydes and -acetones. The compounds prepared include analogues of biologically important purines. ***J. Davoll.*** *Chemical Society, Journal,* 1960, Jan., p. 131-138.

5292 The Thermal Isomerisation of Methyl Geranate and Dihydromyrcene. When heated at 530 C for two seconds, methyl geranate and dihydromyrcene undergo conversion of the isopropylidene into an isopropenyl group. ***G. A. Howard and R. Stevens.*** *Chemical Society, Journal,* 1960, Jan., p. 161-163.

5293 Studies in the Pyrolysis of Organic Bromides. XIV. The Unimolecular Decomposition of n-Pentyl and n-Hexyl Bromides. ***J. H. S. Green, Allan Maccoll, and P. J. Thomas.*** *Chemical Society, Journal,* 1960, Jan., p. 184-187.

5294 Amino-oxy-derivatives. I. Some α-Amino-oxy-acids and α-Amino-oxy-hydrazides. Preparations of the compounds are given. ***D. McHale, J. Green, and P. Mamalis.*** *Chemical Society, Journal,* 1960, Jan., p. 225-229.

5295 The Formation of Aromatic Hydrocarbons at High Temperatures. VI. The Pyrolysis of Tetralin. Mechanisms for the formation of pyrolysis products are suggested. ***G. M. Badger and R. W. L. Kimber.*** *Chemical Society, Journal,* 1960, Jan., p. 266-270.

5296 Some *N*-Substituted 2-Oxobenzimidazolines. Preparation by alkylation of 1-isopropenyl-2-oxobenzimidazoline followed by acid hydrolysis, and from *N*-alkyl-2-nitroanilines. ***J. Davoll and D. H. Laney.*** *Chemical Society, Journal,* 1960, Jan., p. 314-318.

5297 Thiocyanogen Chloride. III. Preparation of Solutions in Acetic Acid and Their Application in the Thiocyanation of Aryl Ethers and Anilides. ***R. G. R. Bacon and R. G. Guy.*** *Chemical Society, Journal,* 1960, Jan., p. 318-324.

5298 Potential Anti-Purines. III. Some 9-Dialkylaminoalkyl-purines and -8-Azapurines. The synthesis is described. Absorption spectra are recorded and discussed. ***J. H. Lister and G. M. Timmis.*** *Chemical Society, Journal,* 1960, Jan., p. 327-331.

5299 Researches on Acetylenic Compounds. LXII. The Preparation and Some Synthetical Applications of Penta-1,2,4-triene and Penta-1,2-dien-4-yne. ***E. R. H. Jones, H. H. Lee, and M. C. Whiting.*** *Chemical Society, Journal,* 1960, Jan., p. 341-346.

5300* Synthesis and Physical Properties of Normal Higher Alcohols. I. Synthesis of Normal Higher Primary Alcohols of Odd Carbon Numbers From Undecanol to Pentacosanol. ***Akira Watanabe.*** *Chemical Society of Japan, Bulletin,* v. 32, no. 12, Dec. 1959, p. 1295-1298.

5301* The Synthesis of Cyclopentane Derivatives. I. *cis*- and *trans*-lactones of 2-α-carboxyethylcyclopentanol were used as the first step in the synthesis. ***Tsuguo Tanaka.*** *Chemical Society of Japan, Bulletin,* v. 32, no. 12, Dec. 1959, p. 1320-1324.

5302* A Synthesis for α-Hydroxy-β-keto-butyraldehyde (Methyl Reductone) and Hydroxymalondialdehyde (Triose-Reductone). (*In German.*) Eine Synthese für α-Hydroxy-β-keto-butyraldehyd (Methylredukton) und Hydroxymalondialdehyd (Trioseredukton). ***Rolf Müller and Hans Plieninger.*** *Chemische Berichte,* v. 92, no. 12, 1959, p. 3016-3023.

5303 Esters of Ethynylphosphonic Acid. Preparation, infrared spectra data, and addition reactions are given for unsubstituted ethynylphosphonates. ***B. B. Hunt, B. C. Saunders, and P. Simpson.*** *Chemistry & Industry,* 1960, no. 2, Jan. 9, p. 47.

5304 Dipyridyl Complexes of Manganese in High Oxidation States. ***R. S. Nyholm and A. Turco.*** *Chemistry & Industry,* 1960, no. 3, Jan. 16, p. 74-75.

5305 The Reaction of Hexamethyl-ditin With Trifluoroiodomethane. Mechanism and application of the reaction. ***R. D. Chambers, H. C. Clark, and C. J. Willis.*** *Chemistry & Industry,* 1960, no. 3, Jan. 16, p. 76-77.

5306 Ozonolysis of Polycyclic Hydrocarbons. ***P. G. Copeland, R. E. Dean, and D. McNeil.*** *Chemistry & Industry,* 1960, no. 4, Jan. 23, p. 98-99.

5307 Properties and Reactions of *Beta*-Propiolactone. The reactions of β-propiolactone with acids and acid derivatives, alcohols, phenols, ammonia, and amines. ***Greville Machell.*** *Industrial Chemist,* v. 36, Jan. 1960, p. 13-20.

5308* The Radiation-Induced Synthesis of the Insecticide "Gammexane". I. Synthesis by Ultra-Violet Light. II. Synthesis by High-Energy Radiation. The optimum conditions for the preparation of 1:2:3:4:5:6-hexachloro*cyclo*hexane by the photo-activated addition of chlorine to benzene were established. A study of the preparation of 1:2:3:4:5:6-hexachloro*cyclo*hexane by radiation from Co-60 showed that the Gammexane content of the crude material is independent of dose rate, benzene concentration, and duration of the chlorination process. ***P. R. Hills, R. Roberts, and M. W. Spindler.*** *International Journal of Applied Radiation and Isotopes,* v. 7, no. 3, Jan. 1960, p. 207-224.

5309* Characterization of Components in Low-Temperature Lignite Tar. The classes of the chemicals in primary tar were studied. Primary tar is composed of materials that distill at temperatures from below 100 to about 350 C, as well as high-molecular-weight, pitchlike materials. All characterization work was done on distillates. Tar acids are primarily phenolic compounds. As tar bases represent only about 4% of the tar, only limited studies were made of their nature. Neutral oil, which represents more than two thirds of primary tar, is principally hydrocarbons: paraffins, olefins, and aromatics. ***E. Jack Kahler, D. C. Rowlands, J. Brewer, W. H. Powell, and W. C. Ellis.*** *Journal of Chemical and Engineering Data,* v. 5, no. 1, Jan. 1960, p. 94-97.

5310* Some Physical Properties of Certain C_6 and C_{10} Aliphatic Acids and Their Methyl Esters. 2-Ethylheptanoic and Pelargonic Acids, and Methyl Esters of 2-Ethylpentanoic,Pelargonic, 2,5-Diethyladipic, 2-Ethylsuberic, and Sebacic Acids. ***Fred M. Trent, Franklyn D. Miller, and***

Glenn H. Brown. *Journal of Chemical and Engineering Data*, v. 5, no. 1, Jan. 1960, p. 110-111.

5311* Purification and Properties of Ten Organic Sulfur Compounds. Stability, physical properties, and mass spectra data are given. ***J. C. Morris, et al.*** *Journal of Chemical and Engineering Data*, v. 5, no. 1, Jan. 1960, p. 112-116.

5312 Rhenium and Its Compounds as Hydrogenation Catalysts. III. Rhenium Heptoxide. Rhenium "blacks" have been shown to be the most effective catalysts yet reported for the hydrogenation of the carboxylic acids to alcohols. They promote this conversion with a wide variety of acids of 150-250 C (usually 160 C)/*ca.* 200 atm. in a few hours, giving excellent yields of alcohols accompanied occasionally by ester by-product. ***H. Smith Broadbent, Graham C. Campbell, William J. Bartley, and John H. Johnson.*** *Journal of Organic Chemistry*, v. 24, Dec. 1959, p. 1847-1854.

5313 Low Pressure Hydrogenation of Ketones With Platinum Metal Catalysts. Aliphatic, aromatic, and α,β-unsaturated ketones were hydrogenated at atmospheric pressure and room temperature in number of solvents by Pd, Pt, Rh, and Ru on high-surface C. ***Edith Breitner, Eleanor Roginski, and Paul N. Rylander.*** *Journal of Organic Chemistry*, v. 24, Dec. 1959, p. 1855-1857.

5314 Organic Carbonates. IV. Factors Affecting Formation of Homologous Cyclic Carbonates. The preparation and properties of a number of branched 1,2-, 1,3-, and 1,4-cyclic carbonates. ***Shalom Sarel, Leo A. Pohoryles, and Raphael Ben-Shoshan.*** *Journal of Organic Chemistry*, v. 24, Dec. 1959, p. 1873-1878.

5315 Anomalous Reactions of Lithium Aluminum Hydride. The preparation and properties of a number of branched 1,2- and 1,3-diols. ***Leo A. Pohoryles, Shalom Sarel, and Raphael Ben-Shoshan.*** *Journal of Organic Chemistry*, v. 24, Dec. 1959, p. 1878-1881.

5316 Fluoroolefins. VII. The Synthesis of 2-Trifluoromethyl-1,3-butadiene. Synthesis by two new methods. One method involves the reaction of trifluoroacetone with malonic acid and the reduction of the resulting β-trifluoromethylcrotonic acid to the carbinol and its dehydration. ***Paul Tarrant and Robert Edward Taylor.*** *Journal of Organic Chemistry*, v. 24, Dec. 1959, p. 1888-1890.

5317 Organic Chemistry of α-Methylstyrene. I. Reactions Leading to *N*-(α,α-Dimethyl-substituted-benzyl)acrylamides. ***Carleton W. Roberts and Norman F. Nuenke.*** *Journal of Organic Chemistry*, v. 24, Dec. 1959, p. 1907-1914.

5318 Composition of Cigarette Smoke. III. Phytadienes. A series of isomeric conjugated phytadienes has been isolated from the cigarette smoke of a cased commercial blend of tobaccos. ***Alan Rodgman.*** *Journal of Organic Chemistry*, v. 24, Dec. 1959, p. 1916-1924.

5319 Synthesis of 6-Fluoro-, 7-Fluoro-, and 6-Methoxy-10-methyl-1,2-benzanthracenes. ***Melvin S. Newman, Sambasiva Swaminathan, and Ramesh Chatterji.*** *Journal of Organic Chemistry*, v. 24, Dec. 1959, p. 1961-1964.

5320 Synthesis of Hydrocarbon Derivatives by the Wittig Reaction. II. Diarylbutadienes and Quinquephenyls. The reaction of triphenylcinnamylphosphonium chloride and *p*-xylylenebis(triphenylphosphonium chloride) with aromatic aldehydes and cinnamaldehydes has given diarylbutadienes and 1,4-bis(4-arylbutadienyl)benzenes in yields of 60-100%. ***Richard N. McDonald and Tod W. Campbell.*** *Journal of Organic Chemistry*, v. 24, Dec. 1959, p. 1969-1975.

5321 Studies in Purine Chemistry. IV. Hypoxanthine-1-*N*-oxide. An unambiguous synthesis of hypoxanthine-1-*N*-oxide, and some of its properties are discussed. ***Edward C. Taylor, C. C. Cheng, and O. Vogl.*** *Journal of Organic Chemistry*, v. 24, Dec. 1959, p. 2019-2021.

5322 Pyrolysis of 1,1-Dichloro-2-vinylcyclopropane. Synthesis of 2-Chlorocyclopentadiene. ***Norman P. Neureiter.*** *Journal of Organic Chemistry*, v. 24, Dec. 1959, p. 2044-2046.

5323 Metal-Organic Compounds. A collection of papers comprising the Symposium on Metal-Organic Compounds, presented before the Division of Industrial and Engineering Chemistry at the 131st National Meeting of the American Chemical Society. Three summary papers surveying the three classes of metal-organic compounds are followed by more detailed consideration of the manufacture, properties, and uses of the metal-organic compounds of 14 of the metals in the 31 papers which comprise the balance of the symposium. 371 pp. 1959. American Chemical Society, Washington 6, D. C. (QD411 Sy99m)

5324* Study of the Kinetics of Reaction of Cumene Cracking on a Pseudoliquefied Aluminum Silicate Catalyst. The test was conducted at 425 C. The speed of reaction of cumene cracking on a fixed microspherical catalyst is less than on a catalyst in the pseudoliquefied state. At determined speed of cumene and N additions, a process characteristic for ideal displacement apparatus takes place. (*In Russian.*) Izuchenie kinetiki reaktsii krekinga kumola na psevdoozhizhennom aliumosilikatnom katalizatore. ***K. V. Topchieva, I. P. Planovskaia, and V. V. Lushnikov.*** *Moscow. Universitet. Vestnik. Seriia Matematiki, Mekhaniki, Astronomii, Fiziki, Khimii*, v. 14, no. 3, 1959, p. 151-157.

5325 Non-Benzenoid Aromatic Compounds. Ferrocene, pentalene, heptalene, the azulenes, tropones, and other compounds are discussed. ***Wilson Baker, et al.*** 543 pp. 1959. Interscience Publishers, New York. (QD331 G43n)

5326* Effects of the Solvent on the Speed of the Diels-Alder Reaction Between Diphenylisobenzofuran and Acrylonitrile. The kinetics of this reaction was studied by means of the spectrophotometry of non-combined diene ($\lambda_m = 4.200$ A) in about 15 very different solvents, between 25 and 110 C, or only up to the boiling point in the case of a volatile solvent. When acrylonitrile is in excess, the order of the reaction is one, as a function of time, with a speed constant proportional to the concentration of the philodiene in excess. (*In French.*) Influence du solvant sur la vitesse de la réaction de Diels-Alder entre le diphénylisobenzofuranne et l'acrylonitrile. ***Jeannine Doucet Gillois and Paul Rumpf.*** *Société Chimique de France, Bulletin*, 1959, nos. 11-12, Nov.-Dec., p. 1823-1825.

5327* Contribution to the Study of the Condensed Sulfured Heterocycles. XI. Investigations in the Field of Semiaromatic Bicyclic Sulfides: Isothiachromans, Homoisothiachromans, Benzo-4,5-thia-1-cycloheptanes and Benzo-5,6-thia-1-cyclooctane. The conditions of cyclization, according to Friedel-Crafts, were studied for acid chlorides of the general formula $C_6H_5\text{-}(CH_2)_n\text{-}S\text{-}(CH_2)_{n'}\text{-}COCl$, with $n = 1,2,3$ and $n' = 1,2,3$ according to the case, as well as for acid chlorides $C_6H_5\text{-}(CH_2)_n\text{-}S\text{-}CH(CH_3)\text{-}COCl$ with $n = 1,2,3$. Different catalysts were used and a comparison of the yields in cyclic ketones obtained was made. (*In French.*) Contribution à l'étude des hétérocycles soufrés condensés. XI. Recherches dans le domaine des sulfures bicycliques semi-aromatiques: isothiachromanne, homoisothiachromanne, benzo-4,5 thia-1 cycloheptane et benzo-5,6-thia-1 cyclooctane. ***Paul Cagniant and Denise Cagniant.*** *Société Chimique de France, Bulletin*, 1959, nos. 11-12, Nov.-Dec., p. 1998-2010.

5328* The Reaction of Triphenylphosphinemethylenes With Lithium Aluminum Hydride. ***Martin Saunders and Grace Burchman.*** *Tetrahedron Letters*, 1959, no. 1, Mar., p. 8-9.

5329* The Synthesis of Cycloöctadecanonaene, a New Aromatic System. Describes the synthesis of cycloöctadecanonaene, the first cyclic polyene after benzene which might be expected to exhibit aromatic properties since it can probably take up a planar or near planar configuration and it contains $(4n + 2)$ π-electrons. ***Franz Sondheimer and Reuven Wolovsky.*** *Tetrahedron Letters*, 1959, no. 3, Apr., p. 3-6.

5330* Intereonversion of Some Pentylbenzenes by Aluminum Chloride. A report of the results of a quantitative study of the reaction of three pentylbenzenes with $AlCl_3$ and an explanation of the relationship between them in terms of a mechanism which correlates this system with the rearrange-

ments of propyl- and butylbenzenes. ***Royston M. Roberts and Yuri W. Han.*** *Tetrahedron Letters,* 1959, no. 6, June, p. 5-8.

5331* The Preparation of N-Disubstituted Formamides. Secondary amines are converted to substituted formamides under the conditions of the carbylamine reaction. On refluxing dibutylamine, diisobutylamine, and diethylamine with chloroform in an aqueous methanolic NaOH solution, dibutylformamide, diisobutylformamide, and diethylformamide were obtained. ***M. B. Frankel, H. Feuer, and J. Bank.*** *Tetrahedron Letters,* 1959, no. 7, July, p. 5-7.

5332* A New Synthesis of 1- and 2-Amino Phenazines. Technique involves oxidation of the diphenylamine with organic nitro compounds. ***A. Gray, G. Gaertner, and F. G. Holliman.*** *Tetrahedron Letters,* 1959, no. 7, July, p. 24-26.

5333* The Specificity of the Ozonization of Polycyclic Aromatics. ***F. T. Wallenberger.*** *Tetrahedron Letters,* 1959, no. 9, Aug., p. 5-9.

5334* Rearrangement of N-Substituted 1-Thiocarbamylazetidines Into Derivatives of 2-Imino-3,4,5,6-tetrahydro-1,3-thiazine. Preparation of some hitherto unknown related compounds with four-membered rings and investigation of their behavior under conditions applied for rearrangement of three-membered rings. ***M. Tišler.*** *Tetrahedron Letters,* 1959, no. 12, Sept., p. 12-15.

5335* Nitroferrocene. Summation of work done on nitroferrocene. ***Heinrich Grubert and Kenneth L. Rinehart, Jr.*** *Tetrahedron Letters,* 1959, no. 12, Sept., p. 16-17.

5336* The Conformation of 2-Fluorocyclohexanone. ***Andrew S. Kende.*** *Tetrahedron Letters,* 1959, no. 14, Oct., p. 13-16.

5337* The Conversion of D-Isoiridomyrmecin Into D-Iridomyrmecin. ***R. H. Jaeger and Robert Robinson.*** *Tetrahedron Letters,* 1959, no. 15, Oct., p. 14-18.

5338* Some Observations Concerning the Copper Salt Catalyzed Reactions of t-Butyl Perbenzoate With Olefins. A corroboration of past fiindings. ***D. B. Denney, D. Z. Denney, and G. Feig.*** *Tetrahedron Letters,* 1959, no. 15, Oct., p. 19-23.

5339* Hydroxyferrocene. Preparation of hydroxyferrocene via ferrocenylboric acid; some properties are given. ***A. N. Nesmeyanov, V. A. Sazonova, and V. N. Drozd.*** *Tetrahedron Letters,* 1959, no. 17, Nov., p. 13-15.

5340* A New Method for the Preparation of 4-Hydroxyflavans. The method involves reduction of a 4-oximinoflavan to the amine which is then converted into a 4-hydroxyflavan. ***R. Bognar and M. Rakosi.*** *Tetrahedron Letters,* 1959, no. 19, Dec., p. 4-8.

5341* Mechanism of Biosynthesis of Squalene From Sesquiterpenoids. ***J. W. Cornforth and G. Popják.*** *Tetrahedron Letters,* 1959, no. 19, Dec., p. 29-35.

5342* Synthesis of the Isomeric Sulphonic Acids of 2,6-Di-*tert.*-butylpyridine. ***H. C. van der Plas and H. J. den Hertog.*** *Tetrahedron Letters,* 1960, no. 1, Jan., p. 13-17.

5343* Synthesis of Thiazole Amino-Acids Derived From Natural Peptides. The thiazole amino-acids were obtained by reaction of the appropriate acetylaminoalkylthioamides with ethyl brompyruvate, and subsequent hydrolysis. ***G. W. Kenner, R. C. Sheppard, and C. E. Stehr.*** *Tetrahedron Letters,* 1960, no. 1, Jan., p. 23-26.

5344 The Alkaloids. Chemistry and Physiology. ***R. H. F. Manske, editor.*** v. VI. 442 pp. 1960. Academic Press, New York. (QD421 M31a)

5345* The Diels-Alder Dimer of Butadiene 4-Vinyl-1-Cyclohexene. A number of methods for preparation and polymerization of vinyl cyclohexene are given. Commercial uses as resins, oils, adhesives, rubber modifiers, plasticizers, solvents, insecticides, and viscosity reducers. ***Irving S. Bengelsdorf, Walter Nudenberg, and Hsiao-Jun Li.*** 32 pp. 1960. Texas-U.S. Chemical Company, Port Neches, Texas. (TP248.H9 T31d)

5346* Investigation in the Series of Diarylmethanes and Their Derivatives. VII. Synthesis of Mesityl-α-naphthylmethane. Thermal Transformation of Higher Condensation Products of Formaldehyde With Mesitylene. (*In Russian.*) Issledovaniia v riady diarilmetanov i ikh proizvodnykh. VII. Sintez mezitil-α-naftilmetana. Termicheskie prevrashcheniia vysshikh produktov kondensatsii formal'degida s mezitilenom. ***N. K. Moshchinskaia, V. I. Chernenko, and B. S. Bouden.*** *Ukrainskĭ Khimicheskĭ Zhurnal,* v. 25, no. 6, 1959, p. 762-766.

5347 The Preparation of 3,3,3-Tris(nitratomethyl)-propene-1 and 3,3-Bis(nitratomethyl)-butene-1. Synthesis of two new vinyl compounds containing nitrate ester groups and having the structures $CH_2 = CHC(CH_2ONO_2)_3$ and $CH_2 = CHC(CH_2ONO_2)_2CH_3$ is described. Many of the intermediates involved in the preparation of these compounds are also described for the first time. ***Lester P. Kuhn and Alan C. Duckworth.*** *U. S. Ordnance Department, Ballistics Research Laboratories, Memorandum Report No.* 1230, Aug. 1959, 24 pp. (UF820 Un3.11m Contin.)

5348* On the Synthesis and Properties of Organo-Bismuth Compounds. (*In Polish.*) O syntezie i własnosciach połaczeń bismutoorganicznych. ***Władysław Lisowski.*** *Wiadomosci Chemiczne,* v. 13, Nov. 1959, p. 641-653.

5349* The Preparation of Organosilicon Compounds. IX. Production of Cyclic Chlorinated Silicon-Methylene Compounds (Cyclocarbosilanes) From CH_3SiCl_3, $(CH_3)_2SiCl_2$, and $(CH_3)_3SiCl$. Chlorinated silicon-methylene compounds can be prepared by thermal decomposition of the methyl chlorosilanes at 700 C. The substances formed are liquids of different viscosity, colorless crystalline compounds, and meltable yellow or red compounds which are soluble in benzene. The conditions applied, results of the methods of preparation, and properties of the decomposition products of three methyl chlorosilanes are described. (*In German.*) Bildung siliciumorganischer Verbindungen. IX. Gewinnung ringförmiger chlorierter Siliciummethylen-Verbindungen (Cyclocarbosilane) aus CH_3SiCl_3, $(CH_3)_2SiCl_2$ und $(CH_3)_3SiCl$. ***G. Fritz, D. Habel, D. Kummer, and G. Teichmann.*** *Zeitschrift für Anorganische und Allgemeine Chemie,* v. 302, nos. 1-2, Nov. 1959, p. 60-80.

5350* A Contribution to the Study of Phosphornitrilic Chlorides. II. Reactions of Nucleophilic Reagents With Trimeric Phosphonitrilic Chloride. The effect of nucleophilic reagents on the quasi-aromatic system of trimeric phosphonitrilic chloride and the mechanism of the substitution reactions is investigated. 2,3,4 or 6 Cl-atoms of $(UNCl_2)_3$ are easily substituted by nucleophilic ligands. Strongly nucleophilic reagents attack in 1- or 3-position. Further substitution follows in 5-position of the six-membered ring system. With weak electron donors as reagents, substitution takes place in another sequence. (*In German.*) Zur Kenntnis der Phosphornitrilchloride. II. Reaktionen von nucleophilen Reagentien mit trimerem Phosphornitrilchlorid. ***Margot Becke-Goehring, Karl John, and Ekkehard Fluck.*** *Zeitschrift für Anorganische und Allgemeine Chemie,* v. 302, nos. 1-2, Nov. 1959, p. 103-120.

CHEMISTRY—PHYSICAL

5351 Kinetics of Oxidation by Aqueous Polysulfide Solutions. II. Rate Dependence of the Oxidation of *m*-Toluic Acid on the Concentration and Chain Length of the Polysulfide Oxidant. The rate of oxidation of sodium *m*-toluate by aqueous sodium polysulfide solutions is proportional to the square root of the concentration of polysulfide molecules. ***William A. Pryor and Louis L. Ferstandig.*** *American Chemical Society, Journal,* v. 82, Jan. 20, 1960, p. 283-288.

5352* The Infra-Red Spectra of 2- and 4-Quinolones. Examination of the infrared spectra of thirty 2- or 4-quinolones shows that discrimination between them on the basis of the frequency of the carbonyl absorption band is not reliable. ***J. R. Price and J. B. Willis.*** *Australian Journal of Chemistry,* v. 12, no. 4, Nov. 1959, p. 589-600.

5353* The Vibrational Spectrum of Methyl *iso*Thiocyanate. Methyl *iso*thiocyanate was studied in the infrared

region from 10,000 to 250 cm^{-1} as vapor, solid, and melt, while the Raman spectrum was recorded in the molten condition. ***A. J. Costoulas and R. L. Werner.*** *Australian Journal of Chemistry*, v. 12, no. 4, Nov. 1959, p. 601-612.

5354* The Infrared Absorption Spectra of Urea-Hydrocarbon Adducts. ***P. H. H. Fischer and C. A. McDowell.*** *Canadian Journal of Chemistry*, v. 38, Feb. 1960, p. 187-193.

5355* The Gas Hydrate of Bromochlorodifluoromethane. An experimental study of the saturation pressure-temperature lines of various bromochlorodifluoromethane systems. Thermodynamic equations and phase reactions are given. ***D. N. Glew.*** *Canadian Journal of Chemistry*, v. 38, Feb. 1960, p. 208-221.

5356 N-Oxides and Related Compounds. XVI. Infrared Spectra of 3-Substituted Pyridine 1-Oxides. The positions and intensities of ten characteristic bands are recorded and discussed for 19 3-substituted pyridine 1-oxides. The preparation of the nicotinic acid and β-pyridylacrylic acid esters and the conversion of pyridines into N-oxides are discussed. ***A. R. Katritzky, J. A. T. Beard, and N. A. Coats.*** *Chemical Society, Journal*, 1959, Dec., p. 3680-3683.

5357 Determination of the Ionization Constant of Hydrocyanic Acid at 25° by a Spectrophotometric Indicator Method. ***K. P. Ang.*** *Chemical Society, Journal*, 1959, Dec., p. 3822-3825.

5358 The Solubilisation of Some Dibasic Fatty Acids by Lecithin in Benzene. Those acids containing an odd number of C atoms were taken up to a larger extent by the micelles than those containing an even number, indicating a different type of packing in the micelle for each sub-series. ***P. H. Elworthy.*** *Chemical Society, Journal*, 1960, Jan., p. 139-144.

5359 Reactions of N-Bromoacetanilides in Chlorobenzene and Benzene Solutions in the Presence of Acetic and Propionic Acids. ***S. C. Chan and G. C. Israel.*** *Chemical Society, Journal*, 1960, Jan., p. 196-201.

5360 Thermochemistry of the Systems Which Boron Trichloride and Gallium Trichloride Form With Acetone and Acetyl Chloride, and the Heat of Solution of Boron Tribromide in Acetone. Gallium trichloride forms a 1:1 complex, m p 42·2 C (decomp.), with acetone; this is the first reported complex of $GaCl_3$ with a ketone. ***N. N. Greenwood and P. G. Perkins.*** *Chemical Society, Journal*, 1960, Jan., p. 356-360.

5361 The Photolysis of Triethylamine, and Reactions of Methyl Radicals With Triethylamine and Diethylamine. A mechanism is proposed to account for the products of the photochemical decomposition. ***P. J. Kozak and H. Gesser.*** *Chemical Society, Journal*, 1960, Jan., p. 448-452.

5362* The Infrared Spectrum of Dimethyl Sulfone. The normal vibrations of this molecule were calculated using force constants of the methanesulfonate ion, and were compared with the experimental values. ***Kuniaki Fujimori.*** *Chemical Society of Japan, Bulletin*, v. 32, no. 12, Dec. 1959, p. 1374-1376.

5363* The Infrared Spectra of Heteroaromatic Compounds. ***A. R. Katritzky.*** *Chemical Society, Quarterly Reviews*, v. 13, no. 4, 1959, p. 353-373.

5364 Index of Refraction of Nitrobenzene in the Infrared. Measuring the reflection in the infrared yields the index of refraction of nitrobenzene in abnormal dispersion regions, that is, in zones where the absorption spectrum exhibits very intensive bands. The precision of these values is of about 0.02 where the bands are intense, and five times higher in the regions of lower dispersion. *(In French.)* Indice de réfraction du nitrobenzène dans l'infrarouge. ***Mireille Cameo.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 249, no. 25, Dec. 21, 1959, p. 2761-2763.

5365 Hydrothermal Preparation of Two-Component Solid Solutions From II-VI Compounds. The hydrothermal method offers the advantages of a sealed system and easily reproducible experimental conditions. Solid solutions of ZnS-HgS, CdS-HgS, and ZnS-CdS were prepared by this method. Results of optical absorption measurements, X-ray analysis, microscopic studies, and the spectral photoresponse of the solid solutions formed are presented. ***A. Kremheller, A. K. Levine, and G. Gashurov.*** *Electrochemical Society, Journal*, v. 107, Jan. 1960, p. 12-15.

5366* The Absorption and Fluorescence Spectra of Uranyl Nitrate Solutions at Room Temperature. The various characteristics observed in regard to the behavior of the different series of fluorescence spectra bands are discussed on the basis of environmental differences of the species in the solid and solution states of uranyl nitrate. ***D. D. Pant and D. P. Khandelwal.*** *Indian Academy of Sciences, Proceedings*, v. 50, sec. A, no. 5, Nov. 1959, p. 323-335.

5367 Dissolution Rate of Uranium in Liquid Metals. At 356 C the rate of dissolution of U in boiling Hg saturated with U decreases with increasing contact time. ***G. J. Segre.*** *Italy, Comitato Nazionale per le Ricerche Nucleari, CNI-16*, June 1959, 8 pp. (QC770 Itl.2ci Contin.)

5368* Activity Coefficients as a Function of Structure and Media. Data given on the solubility of organic compounds in water, solute-water H bonding energies, solubility of alkanes in liquid SO_2, solubility of saturated hydrocarbons in liquid ammonia, and bonding energies between unsaturated hydrocarbons and liquid ammonia. ***N. C. Deno and Henry E. Berkheimer.*** *Journal of Chemical and Engineering Data*, v. 5, no. 1, Jan. 1960, p. 1-5.

5369* Solubilities of Inert Gases in Water. 0° C. to Near the Critical Point of Water. ***D. M. Himmelblau.*** *Journal of Chemical and Engineering Data*, v. 5, no. 1, Jan. 1960, p. 10-15.

5370 Proton Magnetic Resonance Spectrum of Propane. Exact proton magnetic resonance eigenspectra of the spin Hamiltonian are calculated for a system containing one group of six identical protons and one group of two identical protons. ***Donald R. Whitman, Lars Onsager, Martin Saunders, and Hubert E. Dubb.*** *Journal of Chemical Physics*, v. 32, Jan. 1960, p. 67-71.

5371 Theory of Ortho-Para Hydrogen Separation by Adsorption at Low Temperatures, Isotope Separation. A theory of separation of ortho and para hydrogen is developed by considering the energy levels of a three-dimensional hindered rotator. ***David White and Edwin N. Lassettre.*** *Journal of Chemical Physics*, v. 32, Jan. 1960, p. 72-84.

5372 Kinetics of the Surface Degradation of Polymethylmethacrylate. The surface degradation of both linear and cross-linked polymethylmethacrylate was studied over the surface temperature range of 550 to 910 K by means of a hot-plate pyrolysis technique. ***R. F. Chaiken, et al.*** *Journal of Chemical Physics*, v. 32, Jan. 1960, p. 141-146.

5373 Kinetics of the Hydrolysis of Acetyl Chloride. The hydrolysis of acetyl chloride in mixed solvent of acetone-water was investigated by means of an electrical conductance method. ***E. J. Cairns and J. M. Prausnitz.*** *Journal of Chemical Physics*, v. 32, Jan. 1960, p. 169-175.

5374 Microwave Spectrum, Structure, Dipole Moment, and Nuclear Quadrupole Effects in Vinyl Chloride. Moments of inertia, molecular structure, bond angles, and bond length were determined for nine isotopic species of vinyl chloride. ***Daniel Kivelson, E. Bright Wilson, Jr., and David R. Lide, Jr.*** *Journal of Chemical Physics*, v. 32, Jan. 1960, p. 205-209.

5375* The Spectrum of Iron Monochloride in the Visible. The spectrum of FeCl excited both in high-frequency and heavy-current discharges, reveals the existence of four discrete band systems in the region λλ 4690-6560. ***S. Paddi Reddy and P. Tiruvenganna Rao.*** *Journal of Molecular Biology*, v. 4, no. 1, Jan. 1960, p. 16-22.

5376 Studies on Micellar Growth in Surfactant Solutions, With and Without Additives. ***Arun K. Biswas and B. K. Mukherji.*** *Journal of Physical Chemistry*, v. 64, Jan. 1960, p. 1-4.

5377 The Effect of Surface Active Agents on Crystal Growth Rate and Crystal Habit. An anionic agent caused much greater reduction in growth rate of the (010) and (110)

faces of adipic acid crystals than of the (001) face, and the cationic agent had the opposite effect. ***A. S. Michaels and A. R. Colville, Jr.*** *Journal of Physical Chemistry*, v. 64, Jan. 1960, p. 13-19.

5378 Miscibility of Liquid Metals With Salts. IV. The Sodium-Sodium Halide Systems at High Temperatures. ***M. A. Bredig and H. R. Bronstein.*** *Journal of Physical Chemistry*, v. 64, Jan. 1960, p. 64-67.

5379 A Physico-Chemical Study of the System Diphenylmethane-Diphenyl Ether. Freezing point, density, viscosity and refractive index values are reported over the entire range of composition. Activity coefficients, volume changes on mixing and excess free energies of mixing were calculated. ***Robert H. Dettre.*** *Journal of Physical Chemistry*, v. 64, Jan. 1960, p. 67-70.

5380 Dynamic Structure in Detergent Foams. Gives evidence that a hydrous gel structure makes up the surface film in a soap or detergent foam. ***G. F. Dasher and A. J. Mabis.*** *Journal of Physical Chemistry*, v. 64, Jan. 1960, p. 77-83.

5381 The Constitution of Cryolite and NaF-AlF_3 Melts. ***W. B. Frank and L. M. Foster.*** *Journal of Physical Chemistry*, v. 64, Jan. 1960, p. 95-98.

5382 Surface Activity of Fluorinated Organic Compounds at Organic Liquid-Air Interfaces. II. Surface Tension-Concentration Curves, Adsorption Isotherms and Force-Area Isotherms for Partially Fluorinated Carboxylic Esters. III. Equation of State of Adsorbed Monolayers and Work of Adsorption of a Fluorocarbon Group. ***N. Lynn Jarvis and W. A. Zisman.*** *Journal of Physical Chemistry*, v. 64, Jan. 1960, p. 150-160.

5383* The Sorption and Desorption Kinetics of Water in a Regenerated Cellulose. Tentative explanations of these kinetics are advanced in terms of changes of polymer structure. ***A. C. Newns.*** *Journal of Polymer Science*, v. 41, Dec. 1959, p. 425-434.

5384* Kinetics & Mechanism of Acid-Catalysed Phenol-Formaldehyde Reaction. ***L. M. Yeddanapalli and A. K. Kuriakose.*** *Journal of Scientific & Industrial Research*, v. 18B, Nov. 1959, p. 467-475.

5385* Potentiometric & Conductometric Studies in Complex Formation of Beryllium With 1-Hydroxy-2-naphthoic Acid. ***S. C. Tripathi.*** *Journal of Scientific & Industrial Research*, v. 18B, Nov. 1959, p. 476-479.

5386* Vapor-Liquid Equilibrium and Mutual Solubility in the System Cyclohexanone-Water. Results of experimental investigation of the mutual solubility and vapor-liquid equilibrium in the system cyclohexanone-water are presented. The mutual solubility was determined in the temperature interval of 20-96 C. The vapor-liquid equilibrium was determined for the isobaric ($P = 760$ *mm* Hg) and for the isothermal conditions ($t = 90$ C). *(In Russian.)* Ravnovesie zhidkost' -par i vzaimnaia rastvorimost' komponentov v sisteme tsiklogeksanon-voda. ***I. Ia. Gorodetskiĭ, A. G. Morachevskiĭ, and V. M. Olevskiĭ.*** *Leningrad. Universitet. Vestnik*, v. 14, no. 22, 1959, p. 136-139.

5387* Chemical Applications of Pure Quadrupole Spectroscopy. The basic nature of the phenomenon, and examples of the relations that appear between measured quadrupole couplings and the chemical and physical nature of the sample. ***Ralph Livingston.*** *Record of Chemical Progress*, v. 20, no. 4, Dec. 1959, p. 173-186.

5388 Technique of Organic Chemistry. Vol. I. Physical Methods of Organic Chemistry. Pt. I. The 15 chapters deal with automatic control, automatic recording, weighing, temperature measurement, calorimetry, and methods of determining density, particle size, molecular weight, melting and freezing temperatures, boiling and condensation temperatures, vapor pressure, solubility, viscosity, surface and interfacial tension, osmotic pressure and properties of insoluble monolayers at mobile interfaces. ***Arnold Weissberger, editor.*** v. I. 3rd Ed. 894 pp. 1959. Interscience Publishers, Inc., New York. (QD453 W44p3)

5389 The Solubility of Salts in Metals. A visual technique was used to determine the solubilities of metal chlorides in their metals. ***S. J. Yosim and E. B. Luchsinger.*** *U. S. Atomic Energy Commission, NAA-SR-3940*, Aug. 1, 1959, 11 pp. (UF767 Un3.1na Contin.)

5390 Cryoscopic Studies in the Molten Bismuth—Bismuth Chloride System. A series of freezing point depression measurements were made in the metal-rich and salt-rich regions of the Bi-$BiCl_3$ system. ***S. W. Mayer, S. J. Yosim, and L. E. Topol.*** *U. S. Atomic Energy Commission, NAA-SR-4580*, Jan. 15, 1960, 8 pp. (UF767 Un3.1na Contin.)

5391* Studies of Free Radical Reactions in Irradiated Polytetrafluoroethylene. II. Determination of the Rate Constant of the Reactions $\dot{R}O_2 \rightarrow \dot{R} + O_2$ and $\dot{R} + O_2 \rightarrow \dot{R}O_2$. Equilibrium between the radicals $\dot{R}$ and $\dot{R}O_2$ in irradiated polytetrafluoroethylene and the kinetics of decomposition of $\dot{R}O_2$ were studied at various temperatures with the aid of the electron resonance method. *(In Russian.)* Issledovanie reaktsiĭ svobodnykh radikalov v obluchennom politetraftorztilene. II. Opredelenie konstant skorosteĭ reaktsiĭ $\dot{R}O_2 \rightarrow \dot{R} + O_2$ and $\dot{R} + O_2 \rightarrow \dot{R}O_2$. ***D. Tsvetkov, S. Lebedev, and V. V. Voevodskiĭ.*** *Vysokomolekuliarnye Soedineniia*, v. 1, no. 11, Nov. 1959, p. 1634-1642.

5392* Thermodynamic Properties of the Solid System Aluminum-Zinc. A new determination of the thermodynamic functions of the solid Al-Zn system between 300 and 400 C within a range of concentration between 0 and 60 at. % Zn was reported. *(In German.)* Über die thermodynamischen Eigenschaften des festen Systems Aluminium-Zink. ***H. Corsepius and A. Münster.*** *Zeitschrift für Physikalische Chemie*, (Frankfurt), v. 22, nos. 1-2, Oct. 1959, p. 1-19.

5393* Structural Groups of Ions in Hydrocarbons. The purpose of this study was to establish the structural groups of ions present after ozonization of solutions of an aromatic compound and an aliphatic acid in alicyclic hydrocarbons. ***Andrew Gemant.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 22, nos. 3-4, Nov. 1959, p. 209-219.

5394* Thermal Properties of Supercritical Mixtures of Carbon Dioxide and Water at 750° C and 2000 Atm. *(In German.)* Thermische Eigenschaften überkritischer Mischungen von Kohlendioxyd und Wasser bis zu 750° C und 2000 Atm. ***E. U. Franck and K. Tödheide.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 22, nos. 3-4, Nov. 1959, p. 232-245.

5395* Spectrophotometric Investigation of Dark and Photochemical Interaction of Chlorophyll and Tin Chloride. Chlorophyll-a forms molecular compounds with $SnCl_2$ in methanol and acetone solutions. Irradiation of such mixtures with red light produces reduced forms of chlorophyll. *(In Russian.)* Spektrofotometricheskoe issledovanie temnovykh i fotokhimicheskikh vzaimodeĭstviĭ khlorofilla a s khloristym olovom. ***I. I. Dilung and B. Ia. Daun.*** *Zhurnal Fizicheskoĭ Khimii*, v. 33, no. 12, Dec. 1959, p. 2740-2747.

5396* Acid-Base Equilibrium in Anhydrous Acetic Acid. I. Determination of the Dissociation Constants of Acids by the Electromotive Force Method. *(In Russian.)* Kislotno-osnovnye ravnovesiia v bezvodnoĭ uksusnoĭ kislote. I. Opredelenie konstant dissotsiatsii kislot metodom elektrodvizhushchikh sil. ***A. M. Shkodin and L. I. Karkyzaki.*** *Zhurnal Fizicheskoĭ Khimii*, v. 33, no. 12, Dec. 1959, p. 2795-2801.

COATINGS

5397 Extra Durability of Paint on Low-Alloy Steels. Both field tests and service experience have shown that paint coatings are more durable on high-strength low-alloy steels than on C steel or on Cu steel. This improved corrosion behavior is associated with the alloy content of the steels, with the Cu, Ni, Cr, and P contents being particularly important. ***H. R. Copson and C. P. Larrabee.*** *ASTM Bulletin*, no. 242, Dec. 1959, p. 68-74.

5398* Rheology in Search of Structures. II. Experimental procedure, d-c conductivity in sheared dispersion, the dielectric constant, rheological data, and nature of structure are discussed. ***Andries Voet and Wm. N. Whitten, Jr.*** *American Ink Maker*, v. 38, Feb. 1960, p. 32 + 8 pages.

5399 Temporary Organic Binders for Ceramic Systems. II. Starches and dextrins, water-soluble polyvinyl alcohol resins, emulsifying agents, acrylics, sodium carboxymethyl cellulose, methylcellulose, wax emulsions are discussed. ***Sidney Levine.*** *Ceramic Age*, v. 75, no. 2, Feb. 1960, p. 25 + 8 pages.

5400 Chemical Analysis of Resin-Based Coating Materials. Covers analysis of oil-based coating materials, lacquer analysis, and special analytical methods for coatings research. ***C. P. A. Kappelmeier, editor.*** 630 pp. 1959. Interscience Publishers, New York. (TP935 K14c)

5401 Metallic Lead Priming Paints for Marine Usage. ***H. A. Newnham.*** *Corrosion Technology*, v. 6, Dec. 1959, p. 366-368.

5402 The Effect of Tank Coating on Tanker Efficiency. Reviews the principal methods of corrosion prevention in this application, and considers one of the adduct-cured epoxide coating systems. *Corrosion Technology*, v. 6, Dec. 1959, p. 369 + 1 page.

5403 Nodule Growth on Al_2O_3 Coatings. Brief discussion of the growth of "hillocks" and possible mechanisms for their production. ***R. J. Jaccodine.*** *Electrochemical Society, Journal*, v. 107, Jan. 1960, p. 62-63.

5404 The Fatigue Strength of Sprayed-Copper Coatings. If the feed rate is increased, the melting capacity of the flame is strained to the utmost, and may result in a coarse spray of macroparticles of Cu; conversely, when the feed rate is reduced, better atomization is obtained, producing a more homogeneous layer better able to fill cavities in the base metal, resulting in a higher fatigue strength. ***J. Salokangas and P. Lehto.*** *Engineers' Digest*, v. 21, Jan. 1960, p. 105-106. (Translated from *Acta Polytechnica Scandinavica, Mechanical-Engineering Series No.* 6, 1959, 21 pp.) (T1 Ac81me Vis.)

5405* Understanding the Mechanisms of Deterioration of House Paint. Explains how water, especially in conjunction with ultraviolet light, accelerates chemical deterioration. The products of the decomposition cause normal and abnormal failure. Shrinking and swelling caused by water also stress and disrupt paint films. ***F. L. Browne.*** *Forest Products Journal*, v. 9, Nov. 1959, p. 417-427.

5406* Advantages of Steel Pipe Coated With Plastic. ***H. M. McDaniel.*** *Gas Age*, v. 125, Feb. 4, 1960, p. 26 + 2 pages.

5407 Viscosity Measurement. The falling steel ball; rotating paddle; Krebs Units; the flow-out from a Ford or Zahn Cup; and the capillary tube methods are described. ***Charles R. Brown.*** *Industrial Finishing*, v. 36, no. 4, Feb. 1960, p. 30 + 3 pages.

5408 The Steinway Piano Finish. A description. ***Albert G. Geiger.*** *Industrial Finishing*, v. 36, no. 4, Feb. 1960, p. 64 + 4 pages.

5409* New Petroleum Resins. The nature and uses of stable and resistant resins, derived from petroleum fractions, and especially suitable for metal coatings. ***P. Delbende.*** *Industrial Finishing (London)*, v. 12, Jan. 1960, p. 25.

5410* Silicone-Alkyd Copolymers and Their Application to High-Temperature Surface Coatings. ***A. F. Abdul Karim, Brage Golding, and R. A. Morgan.*** *Journal of Chemical and Engineering Data*, v. 5, no. 1, Jan. 1960, p. 117-125.

5411* Production Metallizing Improves Rotor Blades, Cuts Costs. After an approximately 0.045 in. layer of sprayed metal has been applied, the coating is heated to 1900 F and fused to the base metal. *Machinery (New York)*, v. 66, no. 3, Nov. 1959, p. 119-120.

5412 Gas Plating. This process, synonymous with vapor plating or vapor deposition, deposits coatings that cannot be electroplated or applied otherwise in a nonporous condition, can plate plastics and other nonmetallics, will plate irregular surfaces, and produce ultrahigh purity deposits, all at high production rates. Application methods, coating properties, and limitations of the process are discussed. ***Carroll F. Powell.*** *Materials in Design Engineering*, v. 51, Jan. 1960, p. 98-101.

5413 Fluidized Bed: Heavy Coatings in One Dip. Cellulosic, vinyl, epoxy, nylon, polyethylene, chlorinated polyether; tells how coatings perform and where they can be used. ***Walter R. Pascoe.*** *Materials in Design Engineering*, v. 51, Feb. 1960, p. 91-95.

5414* Nonflammable Painting Processes Reduce Costs. Chlorinated solvents are used. ***F. G. Schumacher.*** *Metal Finishing*, v. 58, Jan. 1960, p. 68-72.

5415* Metal Finishing in Europe Today. Current metal finishing practices, particularly in France, Italy, and Germany. ***Daniel A. Marino.*** *Metal Finishing*, v. 58, Feb. 1960, p. 50-54.

5416* Science for the Coatings Technologist. XIV. Additives: Surfactants. Applications of surfactants to the paint and related industries are considered. ***E. S. Beck.*** *Metal Finishing*, v. 58, Feb. 1960, p. 68-72.

5417* New Techniques Coat Diecast Parts. Plastic coatings, far thicker than has been possible in the past, can now be applied to metal parts by a variety of techniques. The coated parts combine the strength and rigidity of metal with the resistance to chemical attack and abrasion, and often attractive surface characteristics, of the thick durable plastic coatings. ***Nigel Vinson.*** *Metalworking Production*, v. 104, no. 2, Jan. 13, 1960, p. 64-67.

5418 New Data on Film Heat Seals. A new laboratory sealer with a number of controllable variables for impulse- and constant-heat sealing is employed for determination on PVC film. ***Rolf Bosvik.*** *Modern Packaging*, v. 33, no. 6, Feb. 1960, p. 123 + 7 pages.

5419* Metal Preparation and Baking. Discussion of the recent developments in coil-fed coating processes. ***Allen S. Dawe.*** *National Lithographer*, v. 67, Feb. 1960, p. 85-88.

5420* Predetermined Designs of Resins. Study of monomolecular layers; relationship between chemical composition and adhesion, and relationship between chemical composition and the absorption of ultraviolet light. ***James Scott Long.*** *Official Digest*, v. 32, Jan. 1960, p. 7-55.

5421* Organic Coatings and Impressed Currents. An electrolytic cell test was developed to screen coatings which may be used in the presence of electrical potentials. Formulations which have resulted from about 600 experiments show unusual promise as coatings to serve with cathodic protection. ***Donald F. Koenecke.*** *Official Digest*, v. 32, Jan. 1960, p. 71-99 + 1 plate.

5422* Solvents for Acrylic Resins. ***F. A. H. Watson.*** *Official Digest*, v. 32, Jan. 1960, p. 100-107.

5423* A Five-Year Exposure Study of Versamid-Epoxy Coatings. ***David Glaser and Don E. Floyd.*** *Official Digest*, v. 32, Jan. 1960, p. 108-134.

5424* The Durability of Exterior Clear Finishes for Timber. Fifty-five finishes were tested on Western red cedar panels. ***V. R. Gray.*** *Oil & Colour Chemists' Association, Journal*, v. 43, Jan. 1960, p. 10-33.

5425* The Flow Properties of Emulsion Paints. Effects of rheological properties, the rate of loss of the aqueous phase of the paint into the substrate and the rate of loss of water by evaporation. ***F. P. Grimshaw and R. A. W. Pateman.*** *Oil & Colour Chemists' Association, Journal*, v. 43, Jan. 1960, p. 34-43.

5426* A Study in Paint Vehicles. IV. ***L. Dintenfass.*** *Oil & Colour Chemists' Association, Journal*, v. 43, Jan. 1960, p. 46-53.

5427* Developments in Aerosol Coatings. II. ***E. C. Roberts.*** *Paint and Varnish Production*, v. 50, no. 2, Feb. 1960, p. 75-77.

5428* Daylight Fluorescent Pigments and Their Uses in Coatings. ***Z. Kazenas.*** *Paint Industry Magazine*, v. 75, Feb. 1960, p. 8 + 4 pages.

5429 Uses of High Boiling Point Solvents in Nitrocellulose Lacquers. ***F. A. H. Watson.*** *Paint Manufacture*, v. 30, Jan. 1960, p. 5-8.

5430 The Functions of Solvents in Paints. Factors affecting the choice of suitable solvents. ***S. R. Finn and W. H. Tatton.*** *Paint Manufacture*, v. 30, Jan. 1960, p. 9-11.

5431 Phenolic Resins. Their chemistry. ***P. M. Fisk.*** *Paint Manufacture*, v. 30, Jan. 1960, p. 12-14.

5432 Residual Stresses in Organic Coatings. Pursues the cause of the internal strains in coated films especially those containing fillers, in order to elucidate the relation between the residual stresses and the adhesion stability of coatings. ***Yukihiko Inoue and Yonosuke Kobatake.*** Paper from "Proceedings of the Second Japan Congress on Testing Materials", The Japan Society for Testing Materials, Kyoto, Japan. 1959, p. 210-213.

5433* Organic Finishes for Metal. VII. Applies to roller coating finishes on metal in the canning industry. ***B. M. Letsky.*** *Product Finishing*, v. 13, Jan. 1960, p. 60-62.

5434 Techniques for Coloring Anodized Aluminum. Alloy selection; surface preparation; anodizing conditions; coloring process; sealing methods. ***R. V. Vanden Berg.*** *Products Finishing*, v. 24, no. 5, Feb. 1960, p. 24-35.

5435* Organic Coatings for Sheet and Strip Metals. ***E. E. V. Sharpe.*** *Sheet Metal Industries*, v. 37, Feb. 1960, p. 97-100.

5436* The Production and Application of Pre-Painted Sheet and Strip. ***I. R. Banks.*** *Sheet Metal Industries*, v. 37, Feb. 1960, p. 101-106.

5437 Exploratory Investigation of Several Coated and Uncoated Metal, Refractory, and Graphite Models in a 3,800° F Stagnation Temperature Air Jet. ***Otto F. Trout, Jr.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-190, Feb. 1960, 73 pp. (TL570 Un3t Vis.)

5438* Surfacing Increases Wear Resistance of Austenitic Manganese Steels. Longer wear with an iron-base hard-surfacing alloy. ***Milton C. Parson.*** *Welding Design & Fabrication*, v. 33, Feb. 1960, p. 68-71.

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

5439 Table of W = Z/(1+Z) for Complex Numbers. ***Karl Holberg and Jens R. Jensen.*** *Acta Polytechnica Scandinavica, Mathematics and Computing Series MA* 3, 1959, 144 pp. (T1 Ac81m Vis.)

5440* Information Transfer. Discusses the transfer tree; the simple counting chain; the endless counting chain; the count-up, count-down chain; and the add-and-subtract counting chain. ***L. B. Mitchell.*** *Automation*, v. 7, Feb. 1960, p. 93-96.

5441 Leprechaun Computer. In a few years, transistorized digital computers will dominate electronic computing. Engineers at Bell Laboratories have made significant contributions to the wane of the electron-tube computer by the development of the small, yet versatile and reliable "Leprechaun" transistor computer and its predecessor, TRADIC. ***J. A. Baird.*** *Bell Laboratories Record*, v. 38, Feb. 1960, p. 58-63.

5442* Early Experiences With an E.D.P. System. This paper, which is based on a talk given to The British Computer Society in London on May 12, 1959, reviews the early experiences of Unilever Ltd. with computer applications. ***T. C. Hickman.*** *Computer Journal*, v. 2, no. 4, Jan. 1960, p. 152-163.

5443* Curve Fitting With a Digital Computer. The Forsythe method, designed to exploit the advantages of high-speed computers, uses orthogonal polynomials to overcome the problems of ill-conditioning which are usually associated with this approach. The present paper shows how this powerful method can be modified to save a substantial proportion of the machine storage. This is achieved by representing each polynomial within the machine by the coefficients in its Chebyshev series. ***C. W. Clenshaw.*** *Computer Journal*, v. 2, no. 4, Jan. 1960, p. 170-173.

5444* A Function Interpretive Scheme for Pegasus. A scheme was developed for use on the Ferranti Pegasus computer whereby a complete formula may be read in without breaking it down into single arithmetic steps. The computer itself subsequently programs the formula, and carries out certain simple types of calculation without the need for detailed instructions. ***J. S. Hornsby.*** *Computer Journal*, v. 2, no. 4, Jan. 1960, p. 174-180.

5445* The Generation of Pseudo-Random Numbers on Electronic Digital Computers. Different methods of generation of sequences of pseudo-random numbers on electronic digital computers are discussed. Statistical tests of randomness which can be applied to such sequences are considered, and an account is given of pseudo-random number subroutines which were written for the Pegasus and Mercury computers. ***A. R. Edmonds.*** *Computer Journal*, v. 2, no. 4, Jan. 1960, p. 181-185.

5446* Some Techniques for Dealing With Two-Level Storage. Describes some devices used in connection with Mercury Autocode to overcome the difficulties of two-level storage, particularly for manipulating matrices stored on the drum. ***R. A. Brooker.*** *Computer Journal*, v. 2, no. 4, Jan. 1960, p. 189-194.

5447* Theoretical Considerations of Routine Maintenance. A model of the value of computer operation is proposed, and its consequences are evaluated far enough to indicate what it is necessary to believe about the benefits of routine or preventative maintenance, in order to make such maintenance valuable. ***E. S. Page.*** *Computer Journal*, v. 2, no. 4, Jan. 1960, p. 199-204.

5448* Some Computer Developments in Sweden. The binary automatic relay calculator, binary electronic calculator, library of programs, spotting errors by the sound rhythm, remote use of the machine, industrial production are discussed. ***Mortimer Datz.*** *Computers and Automation*, v. 8, Nov. 1959, p. 16 + 3 pages.

5449* Computers and Automation in the U.S.S.R. Reports gleanings on computers and automation taken from the first thirty-two issues of the *USSR Illustrated Monthly*. Report is confined to repeating what the Soviet editors say has already been achieved. ***Enoch J. Haga.*** *Computers and Automation*, v. 8, Nov. 1959, p. 26-28.

5450* System Assessment and Initial Design. System approach, major design decisions, beam-riding and command link systems, homing systems, design technique, calculation and simulation, optimized parameters, the effects of radome aberration and other problems are discussed. ***Peggy L. Hodges.*** *Control*, v. 2, no. 15, Sept. 1959, p. 91-95.

5451* Uniselectors Enter Automatic Programme Control. These standard devices are being turned to a new use in the steel industry. Their employment in rolling mills is described here as a pointer to other possible applications. ***H. Law.*** *Control*, v. 2, no. 15, Sept. 1959, p. 96-99.

5452* Piezoelectric and Magnetostrictive Elements. Piezoelectric and magnetostrictive transducers are used in a wide variety of applications, each of which requires different characteristics in the transducers themselves. In the space available it has only been possible to give a brief survey of the

subject, on which there exists a great deal of detailed literature for those who have specific transducer requirements. ***R. E. Fischbacher.*** *Control*, v. 2, no. 15, Sept. 1959, p. 104-108.

5453* Digital Recording in Multipoint Pressure Surveys. I. Remotely sited pressure-switches, embodying electric differential transducers, are automatically checked in this data-handling equipment. The output is on punched tape. ***M. B. Wood and J. N. W. Baldwin.*** *Control*, v. 3, no. 20, Feb. 1960, p. 110-112.

5454* Hydraulic Servos. Electro-hydraulic servo-mechanisms predominate in guided missiles. Here, in the last of our current series on the control of these weapons, are some of the reasons—plus a claim that the e.h. servo is a spearhead in the development of all mechanical servos. ***P. D. Boyer.*** *Control*, v. 3, no. 20, Feb. 1960, p. 115-117.

5455* Electrical Resolvers. Fundamentals of performance, application in Mach computer, internal construction, winding rules, the equivalent circuit, compensation circuits, resistance-type resolvers, and other problems are discussed. *Electromechanical Design*, v. 4, no. 2, Feb. 1960, p. 49 + 21 pages.

5456 General Purpose Digital Computing Systems. Nine general-purpose digital computing systems are commercially available for the control of continuous and batch type industrial processes. For quick reference, these computers are compared in a single table. A general discussion of general-purpose digital computers and the characteristics of the nine control computer systems are included. ***Arthur H. Freilich.*** *Electronic Industries*, v. 19, Feb. 1960, p. 70-75.

5457 Experiments in the Field of Parametric Amplification. Details of construction of a magnetostrictive pump are given. An arrangement similar to that described was also made, using a piezo-electric resonator as the pump. With this arrangement, results were similar to those with the magnetostrictive pump. ***B. Bollée and G. de Vries.*** *Engineers' Digest*, v. 21, Jan. 1960, p. 97-98. (Translated from *Philips Technical Review*, v. 21, no. 2, 1959-1960, p. 47-51.)

5458 Analysis of Periodic Filters With Stationary Random Inputs. General formulas, spectral representation, internal noise sources are discussed. ***Harry Urkowitz.*** *IRE Transactions on Circuit Theory*, v. CT-6, no. 4, Dec. 1959, p. 330-334. (TK1 In6.6c Vis.)

5459 The Generation of Squares With the Use of Nonlinear Resistors. The problem, selection of the circuit, main results, the determination of the numerical values of the resistors, circuit A, some problems that remain to be solved, are discussed. ***E. Grosswald.*** *IRE Transactions on Circuit Theory*, v. CT-6, no. 4, Dec. 1959, p. 334-339. (TK1 In6.6c Vis.)

5460 Direct Single Frequency Synthesis From a Prescribed Scattering Matrix. Definitions and a notation are cited, the synthesis is described and discussed and closing remarks are cited. ***D. C. Youla.*** *IRE Transactions on Circuit Theory*, v. CT-6, no. 4, Dec. 1959, p. 340-344. (TK1 In6.6c Vis.)

5461 Minimal Realizations of the Biquadratic Minimum Function. Realizations of minimum PR functions, the biquadratic minimum function, problems and conjectures are discussed. ***Sundaram Seshu.*** *IRE Transactions on Circuit Theory*, v. CT-6, no. 4, Dec. 1959, p. 345-350. (TK1 In6.6c Vis.)

5462 On the Representation of Transients by Series of Orthogonal Functions. Coefficient of t other than unity, nonrational function of s, demonstration of orthonormality are discussed. ***H. L. Armstrong.*** *IRE Transactions on Circuit Theory*, v. CT-6, no. 4, Dec. 1959, p. 351-354. (TK1 In6.6c Vis.)

5463 Improving the Approximation to a Prescribed Time Response. The development of the procedure and the remainder term are discussed and concluded. ***John D. Brulé.*** *IRE Transactions on Circuit Theory*, v. CT-6, no. 4, Dec. 1959, p. 355-361. (TK1 In6.6c Vis.)

5464 An Extension of Wiener Filter Theory to Partly Sampled Systems. The derivation of the functional equations, solution of the functional equations, the limiting cases of high and low sampling rate, some examples are discussed. ***H. M. Robbins.*** *IRE Transactions on Circuit Theory*, v. CT-6, no. 4, Dec. 1959, p. 362-370. (TK1 In6.6c Vis.)

5465 Network Functions With a Constant Imaginary Part. Derivation of the function, computation of the elliptic functions are discussed. ***H. J. Orchard.*** *IRE Transactions on Circuit Theory*, v. CT-6, no. 4, Dec. 1959, p. 370-374. (TK1 In6.6c Vis.)

5466* Automatic Control in Soviet Industry. Discusses the work of the Institute of Automatics and Telemechanics; Institute of Electromechanics; Central Scientific Institute of Complex Automation; Institute of Automation of the Ukraine; Central Laboratory for Automation, Moscow; Central Scientific Institute for Technology and Machine Building; and Computer Centre of the Academy of Sciences, Moscow. *Instrument Practice*, v. 14, Jan. 1960, p. 54-61.

5467* Approximation Errors in Diode Function-Generators. Using either of two obvious criteria for a "best" fit, the relationship between error and number of segments is obtained from a simple integral, to within the accuracy normally required in analogue-computer applications; the same integral is used to calculate the breakpoints between segments. ***N. Ream.*** *Journal of Electronics and Control*, v. 7, no. 1, July 1959, p. 83-96.

5468 A Palimpsest on the Electronic Analog Art. A collection of reprints of papers and other writings which have been in demand over the past several years. ***H. M. Paynter, editor.*** 270 pp. 1955. Geo. H. Philbrick Researches, Inc., Boston. (QA76 P29p)

5469 Mathematical Models for System Reliability. I. Presents a workable method for determining the reliability of large, complex systems. Repair is an integral part of the model proposed and the usual assumption of component independence is not made. In recognition of the stochastic nature of the time between failures in an electronic system, the reliability of any system is defined in terms of a suitable stochastic process. ***R. E. Barlow and L. C. Hunter.*** *Sylvania Technologist*, v. 13, no. 1, Jan. 1960, p. 16-31.

5470 Fundamental Components of the "Pace" Analog Computer. Equipment complement, attenuators, description of control panel, diode function generators, electronic multipliers, networks, noise generator, operational amplifier, overload alarm system and other problems are discussed. ***William E. Scott.*** *U. S. Atomic Energy Commission, ANL-6075*, Nov. 1959, 55 pp. (UF767 Un3.1an Contin.)

ELECTRICAL ENGINEERING

5471* Energy Conversion by Means of the Seebeck Effect and Refrigeration by the Peltier Effect. General investigation, based on calculations of a thermoelectric couple considered either as an electrical generator, or as a refrigerator using the Peltier effect and description of the work carried out in the C. S. F. laboratories and gives a few results on certain semiconductors. (*In French.*) Conversion d'énergie par effet Seebeck et réfrigération par effet Peltier. ***Nguyen Thien-Chi, J. Vergnolle, and B. Donnadille.*** *Annales de Radioélectricité*, v. 14, no. 58, Oct. 1959, p. 275-321.

5472 Analysis of Quality Factor of Annular Core Inductors. The quality factor, Q, of annular core inductors can be maximized by adapting core dimensions, winding details, etc., to the specific properties of the magnetic core. A graph is supplied showing the maximum Q and optimum frequency for many commercial sizes of annular cores. ***V. E. Legg.*** *Bell System Technical Journal*, v. 39, no. 1, Jan. 1960, p. 105-126.

5473* Single-Column Isolating Switches for 245 and 420 kV. As part of their development program for high-voltage switchgear, Brown Boveri have designed a new type of isolating switch, operating on the scissors or pantograph principle, for a current rating of 2000 A at 245 and 420 kV. The construc-

tional features of the isolators and the conditions they have to fulfill in service are described. ***J. Schneider.*** *Brown Boveri Review*, v. 46, no. 9, Sept. 1959, p. 490-496.

5474* Metalclad Switchgear With Magnetic Circuit-Breakers for 3·6 and 7·2 kV. Metalclad switchgear has attracted increasing attention in Europe in the past few years. Gives description of a design newly developed by Brown Boveri which is able to fulfill all these requirements while complying with the standards and particular views of the various countries. ***J. Latzko.*** *Brown Boveri Review*, v. 46, no. 9, Sept. 1959, p. 497-506.

5475* Arc Tests on Open-Type Switchgear Cells. In the Brown Boveri high-power testing station in Baden, arc tests were carried out on open-type switchgear cells to determine the effects of short-circuit arcs on the cells and their surroundings. The article deals with a series of experiments performed on 10- and 30-kV cells. ***A. Mayer.*** *Brown Boveri Review*, v. 46, no. 9, Sept. 1959, p. 507-524.

5476 Thermo-Electron Engines as Practical Power Sources. The source of heat which can be used with thermo-electron engines may originate from the burning of fossil fuels, from solar energy, or from nuclear energy originating in radioactive isotopes or in fission reactions. Thermo-electron engines using nuclear or solar energy have the interesting characteristic of long useful life and small weight-to-energy ratio. ***G. N. Hatsopoulos, J. Welsh, and E. Langberg.*** *Engineers' Digest*, v. 21, Jan. 1960, p. 99-101. (Translated from *Electronics*, v. 32, no. 46, Nov. 13, 1959, p. 69-72.)

5477 The Present Status of Vapour-Cooled Transformers. Fluorocarbons as coolants and insulators are discussed. ***P. Narbut and G. A. Monito.*** *Engineers' Digest*, v. 21, Jan. 1960, p. 101-103. (Translated from *Westinghouse Engineer*, v. 19, no. 6, Nov. 1959, p. 162-166.)

5478* Problems and Progress in Electroluminescent Lamps. Considers some of the problems encountered in the design and construction of electroluminescent lamps for various applications. Factors affecting maintenance of output during life, effects of the particle size of the phosphor used, effects of the resistance of the electrodes, and an optical problem involving small illuminated areas are discussed. ***Henry F. Ivey.*** *Illuminating Engineering*, v. 55, Jan. 1960, p. 13-23.

5479* Electroluminescent Sources in Automotive Instrument Lighting. Good instrument panel lighting is a must on modern automobiles. Electroluminescence is a new practical tool for use in the development of improved panel lighting in a precise, scientific manner. ***J. M. Harris and P. J. Blinkilde.*** *Illuminating Engineering*, v. 55, Jan. 1960, p. 32-37.

5480* The Thermoelectric Figure of Merit and Its Relation to Thermoelectric Generators. The expression for the figure of merit of a semiconductor of given carrier mobility and lattice thermal conductivity expressed in terms of generalized Fermi-Dirac functions has been numerically evaluated for various scattering indices. The results are presented graphically enabling the maximum figure of merit to be found. ***R. P. Chasmar and R. Stratton.*** *Journal of Electronics and Control*, v. 7, no. 1, July 1959, p. 52-72.

5481* The Figure of Merit of a Thermoelectric Generator. Optimum conditions are deduced for a thermoelectric generator or refrigerator with *n*- and p-type semiconducting branches which have different physical parameters. The results are related in a simple manner to the previously calculated optimum conditions for the individual figure of merit of a single substance. ***R. Stratton.*** *Journal of Electronics and Control*, v. 7, no. 1, July 1959, p. 73-76.

5482 Geometric-Analytic Theory of Transition in Electrical Engineering. A geometric-analytic theory of transition is presented and applied to circuit theory. A transition from one state to another is represented in a complex plane by two points which, by variation of a parameter, approach each other, coalesce, and then separate along trajectories perpendicular to the original trajectories. ***E. Folke Bolinder.*** *U. S. Air Force, Cambridge Research Center, AFCRC-TR-59-181*, Aug. 1959, 6 pp. (TK7800 Un3.12b Contin.)

5483 Interim Report on Investigation of Dynamic Characteristics of Relays. Presents a deviation of the transient characteristics in a group of relays, an evaluation of a set of relays as to air gap, residual gap and spring tension, variations in the transient coil current for consecutive operations of a relay, influence of variable supply voltage on relay operation, instantaneous difference of the coil current of two relays. *U. S. Atomic Energy Commission, SC-4380 (RR)*, Jan. 1960, 122 pp. (UF767 Un3.1sc Contin.)

See also: **5504** (printed circuits with Pd); **6084** (epoxy embedments); **6095** (dielectric properties of polyamides).

ELECTROCHEMISTRY

5484 Incorporation of Aqueous Solutions of Potassium Dichromate Into Electrode Coatings. Suggested electrode and coating compositions. ***N. A. Gorpeniuk and A. V. Pechatnov.*** *Henry Brutcher Translation No.* 4669, 4 pp. (From *Svarochnoe Proizvodstvo*, no. 1, Jan. 1958, p. 32.) Henry Brutcher, Altadena, Calif.

5485 Control in Electroplating. Four papers on technical control of electroplating processes and solutions presented at the one-day symposium sponsored by the London Branch of the Institute of Metal Finishing. Subjects are of general interest. 92 pp. 1959. Robert Draper, Ltd., Teddington, England. (TS670 In7c)

5486 A Study of the Zinc-Noble Metal Couple in Alkaline Solutions. A metal-like coating is formed frequently on Cu or Ag leads which are attached to the Zn electrodes in commercial Zn-alkaline cells. This coating is Zn or a Zn-rich alloy. The conditions under which this coating is formed were studied, and several possible mechanisms for its formation are presented. ***Thedford P. Dirkse and Edwin G. Vrieland.*** *Electrochemical Society, Journal*, v. 106, Dec. 1959, p. 997-999.

5487 The Anodic Dissolution and Electrolytic Polishing of Metals. An experimental study was made, using the potentiostat technique of Ni in hydrochloric acid. The effect of experimental conditions on the potential/current density curves and the value of the limiting current density were investigated. Results were interpreted on the basis of a simple diffusion mechanism, and complications arising from the thick salt films found in the more concentrated solutions were considered. ***J. K. Higgins.*** *Electrochemical Society, Journal*, v. 106, Dec. 1959, p. 999-1005.

5488 An Investigation of Chemical Variables Affecting the Formation of Films on Copper in Aqueous Solutions. Quantitative data were obtained on the growth of films as a function of the solution variables; anion type and concentration, *p*H, and O concentration. ***W. H. Davenport, V. F. Nole, and W. D. Robertson.*** *Electrochemical Society, Journal*, v. 106, Dec. 1959, p. 1005-1009.

5489 Galvanic Relationships Between Aluminum Alloys and Magnesium Alloys. I. Galvanic Couples. II. Aluminum Claddings on Magnesium. ***M. R. Bothwell.*** *Electrochemical Society, Journal*, v. 106, Dec. 1959, p. 1014-1021.

5490 A Study of Stripping Anodized Coatings From an Aluminum Alloy. Effect of a HF-HNO_3 mixture. Comparison of efficacy and amount of metal attack was made with that of the CrO_3-H_3PO_4 solution usually used for this purpose. Information about some of the variables which control the process of film stripping was obtained from weight loss determinations, microscopic and electron microscopic studies. ***Walter Beck, John Danovich, and Sara J. Ketcham.*** *Electrochemical Society, Journal*, v. 106, Dec. 1959, p. 1063-1065.

5491 Electrolytic Reduction of Thorium Oxide. Thorium metal was prepared by electrolytic reduction of ThO_2 in two systems, a fused KF-ThF_4 mixture and a fused $NaCl$-KCl-$ThCl_4$ mixture. Electrolysis in the fluoride melt proved to be a superior process, the metal product having higher purity and larger average particle size than the product from the chloride melt. In addition, the recovery of Th from recycle

streams proved to be much simpler in the fluoride process than in the chloride process. The feasibility was demonstrated for all the essential steps of a complete process for production of the metal in the fluoride system. ***L. H. Meyer.*** *Electrochemical Society, Journal*, v. 107, Jan. 1960, p. 43-47.

5492 Electrolytic Conductance. Electrostatics and vectors; hydrodynamics; statistical mechanics; thermodynamics; potential of the ionic atmosphere; activity coefficients; distribution functions; equations of continuity and motion; boundary conditions; relaxation field to first approximation; differential equation for second approximation; velocity field; conductance function for unassociated 1–1 electrolytes; ionic association to pairs; ionic association higher than pairwise. ***Raymond M. Fuoss and Filippo Accascina.*** 279 pp. 1959. Interscience Publishers, New York. (QD565 F96e)

5493* Practical Aspects of Hard Chromium Plating. Developments in lead and plastic linings and also in connection with plastisol coatings. In general, round are far superior to flat anodes. A final section compares the orthodox chromic/-sulfuric acid solution and hard chromium plating with the silico-fluoride solution and concludes that the latter is generally to be preferred. ***C. F. Corfe.*** *Electroplating and Metal Finishing*, v. 13, Jan. 1960, p. 3-8.

5494* Phosphating, Electropolishing and High Speed Chromium Plating in Buffer Production. After dimensional checking, pistons were jigged, degreased with liquid trichlorethylene spray, electropolished, spray swilled, desmutted electrolytically and then hard chromium plated. Lead cathodes were used. ***H. L. Watts.*** *Electroplating and Metal Finishing*, v. 13, Jan. 1960, p. 15-19.

5495* Fabricating Qualities of Pre-Finished Metals. Effect of the electrodeposition of Cu, Ni, Cr, and brass upon the fabricating properties of sheet or strip steel. ***F. P. Romanoff.*** *Metal Finishing*, v. 58, Feb. 1960, p. 55-62.

5496* German Plating Conference at Schwabisch Gmünd. Abstracts of nineteen papers presented at the Conference; various topics in surface-cleaning, electroplating, corrosion of metallic-surfaces. ***R. Pinner.*** *Metal Finishing*, v. 58, Feb. 1960, p. 63-67.

5497* Science for Electroplaters. LIV. The Rochelle Salt Bath. ***L. Serota.*** *Metal Finishing*, v. 58, Feb. 1960, p. 75-76.

5498* Improved Aluminum Alloys for Bright Anodizing. Aluminum of commercial purity with balanced Mg and Si additions, or alloys of the Al-Zn-Mg-Cu family, all produced under rigid control in mill and heat treating operations, give an excellent combination of low cost, good strength, and high reflectivity. ***F. Howitt and I. H. Jenks.*** *Metal Progress*, v. 77, no. 1, Jan. 1960, p. 87-91.

5499* Electropolishing of Columbium and Tantalum. Electropolishing in a solution containing hydrofluoric acid proves best for preparing Cb and Ta specimens for microhardness measurements. ***O. J. Krudtaa and K. Stokland.*** *Metal Progress*, v. 77, no. 1, Jan. 1960, p. 101-103.

5500 The Use of Malonic Acid as an Anodising Electrolyte. Discusses the various anodic films which can be obtained from a 12.5% *w/v* electrolyte using different current densities, temperatures and voltages. The coatings formed are of a deep yellow or sepia color, and can be extremely hard, corrosion resistant and abrasion resistant, and possess a high inherent light fastness. ***J. M. Kape.*** *Metallurgia*, v. 60, Nov. 1959, p. 181-191.

5501 Improving the Quality of Chromium Plating. A new British Standard B.S. 1224:1959, suggesting possible up grading of electroplated Cr finishes. *Metallurgia*, v. 60, Nov. 1959, p. 191.

5502* Hydrogen Embrittlement of High-Strength Steels During Cadmium, Chromium and Electroless Nickel Plating. Delayed, brittle failures of stressed high-strength steel parts have resulted from H pick-up during plating processes. Embrittlement resulting from Cd, Cr, and electroless Ni plating was evaluated using five representative aircraft steels heat-treated to various tensile strengths up to 300,000 psi. ***William L. Cotton.*** *Plating*, v. 47, Feb. 1960, p. 169-175.

5503* Gages for Measuring the Thickness of Chromium on the Internal Surface of Small-Bore Tubes. Two gages of the eddy-current type for measuring the thickness of Cr coatings on the internal surface of caliber 0.30 and caliber 0.50 gun barrels were developed. Measurements are nondestructive and are localized to a small area, less than ⅛ inch diameter. The gages may readily be modified to be generally applicable to the measurement of the thickness of various coatings on the internal surfaces of metallic tubes of the same or larger diameters. ***Vernon A. Lamb and Paul A. Krasley.*** *Plating*, v. 47, Feb. 1960, p. 176-179.

5504* Palladium Plating of Printed Circuits. Where low and stable values of contact resistance are required in a printed circuit, the contact surfaces are locally electroplated with a noble metal. The physical properties of Pd, combined with its relatively low cost and the ease with which it can be applied, make it an ideal metal for this purpose. ***J. E. Philpott.*** *Platinum Metals Review*, v. 4, no. 1, Jan. 1960, p. 12-14.

5505* Tantalum-Platinum and Titanium-Plating Bi-Electrodes. Anodic Behaviour in Electrolytes of Low Conductivity. ***L. L. Shreir.*** *Platinum Metals Review*, v. 4, no. 1, Jan. 1960, p. 15-17.

5506 Electrorefining of Irradiated Thorium-Uranium Alloy. The alloy is dissolved anodically into a fused salt bath of NaCl-KCl eutectic and deposited in a molten Zn cathode. Experiments with irradiated material resulted in the separation of 80 to 90% of the total fission product activity. The product is an alloy of Th, U, and Zn. The Zn can be removed by vacuum distillation. ***W. N. Hansen, W. L. Long, and E. W. Murbach.*** *U. S. Atomic Energy Commission, NAA-SR-4660*, Jan. 15, 1960, 14 pp. (UF767 Un3.1na Contin.)

5507 Scoping Studies on the Electrolytic Reduction of Magnesium Fluoride. Laboratory-scale scoping tests on the fused salt electrolytic reduction of (MgF_2) were completed. Magnesium metal of high purity was produced. The reduction was accompanied by the evolution of F gas. Concentration of the U values in the lower region of the electrolyte was noted. ***Robert B. Steck and Vincent G. Minutolo.*** *U. S. Atomic Energy Commission, NLCO-796*, Jan. 15, 1959, 33 pp. (UF767 Un3.1nL Contin.)

ELECTRONICS

5508 Parametric Amplifiers. As is the case with most devices still undergoing development, the parametric amplifier has peculiarities of its own; they require careful adjustment and there is sometimes difficulty in maintaining consistent operation over a period of time. Nevertheless, this kind of amplifier does hold promise of giving practical noise-free amplification with only relatively simple components. ***W. J. Cunningham.*** *American Scientist*, v. 47, no. 4, Dec. 1959, p. 480-491.

5509* Effects of Technological Conditions and of Diffusion on the Properties of a Drift Transistor. The value of introducing certain parameters is brought out. An equivalent circuit and the limits of its validity are deduced from the examination of these characteristics; this is followed by an exposition of the principle of verification measurements; concludes with a synthesis based on a number of electrical data as a guide in the development of the element. *(In French.)* Influence de la technologie et de la diffusion sur les caractéristiques d'un transistor du type drift. ***J. Mercier.*** *Annales de Radioélectricité*, v. 14, no. 58, Oct. 1959, p. 322-338.

5510* Theory of Gain of a Transistor and Carrier Distribution in the Base. Gives a theory of gain as a function of junction transistor current. Sets out an analytic expression for the gain curve and shows how the geometric and electric magnitudes of the transistor may be related to the parameters of that curve. Compares pnp and npn transistors

from the gain point of view. A mathematical analysis of the carrier distribution in the base gives a measurement of the recombination rate s of the carriers on the surface of the transistors. *(In French.)* Théorie du gain d'un transistor et répartition des porteurs dans la base. ***J. Della Riccia.*** *Annales de Radioélectricité*, v. 14, no. 58, Oct. 1959, p. 366-374.

5511* Automating Transistor Assembly. The advantages of mechanized assembly are enticing—quantity production, quality product, lower costs. Development of a successful automatic assembly machine for transistors is described. ***Richard C. Shafer.*** *Automation*, v. 7, Feb. 1960, p. 83-91.

5512 A High-Performance Tetrode for TH Radio Relay. The over-all capability of a system depends heavily on the high performance of its components. In one of these components, a new electron tube for the TH system, careful attention to subtle design details and judicious integration of tube and circuit have led to a significant advance in tube performance. ***T. E. Talpey and N. C. Wittmer.*** *Bell Laboratories Record*, v. 38, Feb. 1960, p. 64-67.

5513 Redesign of Low-Frequency Networks. Packaging engineers at Bell Laboratories are using modern components, materials and techniques to effect radical changes in the physical design of electronic equipment. They have recently completed a redesign of certain Bell System networks that will make these units less expensive, more rugged and more reliable than their presently obtainable counterparts. ***L. H. Steiff.*** *Bell Laboratories Record*, v. 38, Feb. 1960, p. 68-71.

5514 The Ferreed—A New Switching Device. An experimental switching device is described that has the following properties: (a) sealed metallic contacts, (b) control times in the microsecond range, (c) coincident selection, (d) memory without holding power and (e) small size. The device, named the ferreed, may be used as a crosspoint in telephone switching networks of the space-separation type. ***A. Feiner, C. A. Lovell, T. N. Lowry, and P. G. Ridinger.*** *Bell System Technical Journal*, v. 39, no. 1, Jan. 1960, p. 1-30.

5515 Electrical Properties of Gold-Doped Diffused Silicon Computer Diodes. Planar diffused Si junctions with storage times of one millimicrosecond or less are readily obtained by Au doping. The process of Au doping by diffusion and its effect on electrical characteristics of diffused Si computer diodes are discussed. ***A. E. Bakanowski and J. H. Forster.*** *Bell System Technical Journal*, v. 39, no. 1, Jan. 1960, p. 87-104.

5516* Communication Satellites. Active and passive satellites, basic programs, first experiments, noise and other problems are discussed. ***John R. Pierce.*** *Bell Telephone Magazine*, v. 38, no. 4, Winter, 1959-1960, p. 25-31.

5517* Concerning the Calculation of the Coefficient of Diamagnetic Magnetization of the Molecules. If the ionization energies of the atoms and of the molecules and the simple linkage energies are taken into account, it is possible to make a correct calculation of the coefficients of diamagnetic magnetization of the molecules and a distribution of the interatomic energy exchanges. *(In French.)* Sur le calcul du coefficient d'aimantation diamagnétique des molécules. ***Clément Courty.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 249, no. 25, Dec. 21, 1959, p. 2740-2742.

5518* Components Digest II, Potentiometers. II. High Temperature Potentiometers. Bourns reports that they have developed a prototype model of a wire-wound potentiometer that operates successfully in excess of 350 C. Predicts that a large percentage of their developments in the very high-temperature potentiometer field will use film-type elements. *Electromechanical Design*, v. 4, no. 1, Jan. 1960, p. 41 + 6 pages.

5519* Materials and Techniques for High Temperature Components. *Electromechanical Design*, v. 4, no. 1, Jan. 1960, p. 48-51.

5520* Techniques in the Application of Silicon Power Rectifiers. Silicon rectifiers have, in just a few years, been used successfully in almost every type of rectifier application. Other applications include rectifiers for high voltage electrostatic precipitation, electrified railway cars, television power supplies, circuit breaker closing coils, and atomic reactor control rod supplies. ***Robert D. Lynch.*** *Electromechanical Design*, v. 4, no. 2, Feb. 1960, p. 30 + 9 pages.

5521* Unveil Molectronic Telemetry System. Varying levels of illumination in space can be interpreted by an optically tuned relaxation oscillator fabricated in a single small semiconductor device. *Electronic Digests*, v. 7, no. 6, Jan. 1960, p. 15 + 1 page.

5522* A Review of Colour Television in the U.K. Since 1953 the British Broadcasting Corporation has taken an active interest in color television and in the intervening years they have carried out a considerable amount of work in determining the adaptability of the American N.T.S.C. standards to the British 405 line system. A number of reports and a BBC Engineering Division Monograph have been published on this work: the present article provides a concise summary for those already versed in color television technology. ***R. D. A. Maurice.*** *Electronic Engineering*, v. 32, Feb. 1960, p. 68-73.

5523* The Characteristics and Applications of Zener (Voltage Reference) Diodes. The detailed characteristics of Zener diodes are presented and curves are given showing the variation of a.c. and d.c. slope resistance with both current and voltage, breakdown voltage variation with temperature, and the forward characteristics of the diodes. The general circuit of the simple stabilized supply is considered, with the limitations due to the diode and circuit limits. Temperature compensation of the diodes is considered and results shown. ***J. A. Chandler.*** *Electronic Engineering*, v. 32, Feb. 1960, p. 78-86.

5524* A Transistor-Thermistor Feedback Quadrature Suppressor. Quadrature effects in a.c. servo systems are eliminated if the amplified residual signal is demodulated and used to control a negative feedback signal precisely in quadrature phase with the a.c. reference. A design of suppressor is described which uses transistor pre-amplification. ***I. C. Hutcheon and D. N. Harrison.*** *Electronic Engineering*, v. 32, Feb. 1960, p. 87-91.

5525* Fast Counting Circuits Using EIT Tubes. The limits of accurate counting against the reliability required are determined theoretically and experimentally. It is found possible to use EIT tubes up to about 10^6 pulses per second. A circuit diagram of a reliable fast counting decade suitable for general application is presented. ***V. Radeka.*** *Electronic Engineering*, v. 32, Feb. 1960, p. 92-95.

5526* Some Performance Parameters of Silicon Junction Power Rectifiers. Temperature control is discussed from the thermal resistance standpoint, and a method is given for the calculation of power dissipation and connection ratings for Si rectifiers. Mention is made of some considerations necessary for satisfactory transient performance. ***D. R. Coleman.*** *Electronic Engineering*, v. 32, Feb. 1960, p. 98-102.

5527* The Electronic Guide. A Concise and Handy Reference Directory of Electronic Articles. ***David Early, editor.*** v. I. 191 pp. 1959. References for Research Division, Electronic Guide Publishing Co., Burbank, California. (Z5836 EL25 Ref.)

5528 "TPR" Recording. New method for recording electrical signals on a thermoplastic film employs electron gun recorder. System has response capabilities to 50MC. Many new military and industrial recording applications envisioned. *Electronic Industries*, v. 19, Feb. 1960, p. 76-79.

5529 Designing Input Trigger Circuits. For a wide variety of jobs, the circuit described offers correct, reliable output information at low cost. It is virtually independent of input rise time, can handle large variations in input amplitude and d-c level, and rejects noise. ***Richard Kimes.*** *Electronic Industries*, v. 19, Feb. 1960, p. 101-105.

5530* English-Russian, Russian-English Electronics Dictionary. Published to aid the English-speaking researcher, translator, writer, editor, or engineer who has occasion to use Russian language publications on Electronics and Telecommunication. Though a pioneer in its field, the dictionary is believed to be reasonably comprehensive, as all modern sources available were used in the compilation. 944 pp. Aug. 1956.

U. S. Department of the Army, Washington, D. C. (T9 Un3.1e Ref.)

5531 Fluctuation Phenomena in Semi-Conductors. Characterization of noisiness in two- and four-terminal networks, mathematical methods, generation-recombination noise in the case of thermal equilibrium, flicker noise in semiconductor material, noise in photoconductors, noise in semiconductor resistors, shot noise in semiconductor diodes, shot noises in junction transistors, flicker noise in diodes and transistors are discussed. ***A. Van Der Ziel.*** 168 pp. 1959. Butterworths Scientific Publications, London. (TK7872.S4 V28f)

5532 Delay-Line Secondary Responses in AM and FM Sweep Integrators. FM alleviates the buildup effect of secondaries by introducing a small amount of hum deviation on the carrier frequency, which results in a random buildup. ***Harry Urkowitz.*** *Franklin Institute, Journal*, v. 269, no. 1, Jan. 1960, p. 1-23.

5533* Handbook of Electronic Measurements. Electromagnetic fundamentals; measurement of voltage and current, power, impedance and circuit elements; measurement of frequency and wavelength. Measurement of time interval, phase, field intensity and radiation, band-width, gain; measurement of noise figure; the transient response of electronic design, distortion, oscillographic observation of waveforms and other problems are discussed. ***Moe Wind, editor.*** v. I-II. Sections individually paged. 1956. Polytechnic Press, Brooklyn, N. Y. (TK7882.M4 B79.5h Ref.)

5534* Design Methods for Maximum Minimum-Distance Error-Correcting Codes. ***J. E. MacDonald.*** *IBM Journal of Research and Development*, v. 4, no. 1, Jan. 1960, p. 43-57.

5535* A New Group of Codes for Correction of Dependent Errors in Data Transmission. Multiple related errors of any configuration can be automatically corrected by a class of codes having the property of using two groups of parity bits, one defining the error pattern, the other determining the location of the errors within the block. ***C. M. Melas.*** *IBM Journal of Research and Development*, v. 4, no. 1, Jan. 1960, p. 58-65.

5536* PERCOS—Performance Coding System of Methods and Devices Used for Measurement and Control. The performance coding system consists of numeric codes for rating a device in terms of 12 parameters of importance to the overall performance of the system, such as precision, stability of calibration, rate of performance, useful shelf life, mean operating time to failure, average repair time, cost, availability and physical volume. ***Ernest A. Keller.*** *I.R.E. Proceedings*, v. 48, Feb. 1960, p. 148-155.

5537* 100:1 Bandwidth Balun Transformer. The balun is an impedance matching transition from coaxial line to a balanced, two-conductor line. The balun impedance is tapered so that the input reflection coefficient follows a Tchebycheff response in the pass band. ***J. W. Duncan and V. P. Minerva.*** *I.R.E. Proceedings*, v. 48, Feb. 1960, p. 156-164.

5538* Measurement of Internal Reflections in Traveling-Wave Tubes Using a Millimicrosecond Pulse Radar. This test method employs millimicrosecond pulses in a radar circuit with a stroboscopic viewing system. The sensitivity of the system permits easy observation of reflections having return losses as high as 40 db. ***D. O. Melroy and H. T. Closson.*** *I.R.E. Proceedings*, v. 48, Feb. 1960, p. 165-168.

5539* Noise Consideration of the Variable Capacitance Parametric Amplifier. Essential differences between single- and double-sideband reception are discussed. Of the experimental data obtained thus far, the best result has been with a gallium arsenide diode which yields a 0.9 db double-sideband noise figure and, equivalently, 3.9 db for single-sideband operation with 16 db gain and 25 mc of single-sideband frequency bandwidth. ***M. Uenohara.*** *I.R.E. Proceedings*, v. 48, Feb. 1960, p. 169-179.

5540* Reliability Analysis Techniques. Reliability estimates enable early pinpointing of low reliability. Catastrophic failures can be controlled and performance change failures reduced through analytical techniques. Redundant techniques allow further reliability improvement even though failures occur. ***Charles A. Krohn.*** *I.R.E. Proceedings*, v. 48, Feb. 1960, p. 179-192.

5541* A Stabilized Locked-Oscillator Frequency Divider. The oscillator combines some of the characteristics of sinusoidal and relaxation oscillators to provide a high degree of frequency stability while allowing sufficient tendency for synchronization. The analytical results are obtained in a graphical form which is easy to handle and which could be used as a design procedure for stabilized frequency dividers. ***Philip R. Scott.*** *I.R.E. Proceedings*, v. 48, Feb. 1960, p. 192-200.

5542* IRE Standards on Television: Measurement of Differential Gain and Differential Phase, 1960. Definitions, analysis of the measurement problem, requirements for standard measurements, methods of measurement, limitations and comments are discussed. *I.R.E. Proceedings*, v. 48, Feb. 1960, p. 201-208.

5543* Compandor Loading and Noise Improvement in Frequency Division Multiplex Radio-Relay Systems. Graphical and numerical means are developed to compute the additional effective loading caused by the use of syllabic compandors on the input of a multichannel radio-relay system, and to evaluate the noise improvement yielded by the compandor in a telephone channel. ***Eitel M. Rizzoni.*** *I.R.E. Proceedings*, v. 48, Feb. 1960, p. 208-220.

5544* Piezoelectric Properties of Polycrystalline Lead Titanate Zirconate Compositions. Detailed data are given for the piezoelectric, elastic, and dielectric properties of lead titanate zirconate ceramic compositions near the rhombohedral-tetragonal phase boundary. These compositions have markedly higher electromechanical coupling factors, remanent ferroelectric charge, and coercive field, than ceramic barium titanate. ***D. A. Berlincourt, C. Cmolik, and H. Jaffe.*** *I.R.E. Proceedings*, v. 48, Feb. 1960, p. 220-229.

5545* Further Consideration of Bulk Lifetime Measurement With a Microwave Electrodeless Technique. A new method for measurement of the lifetime of excess carriers in semiconductors is described. Using a steady light source and measuring changes in microwave power absorption as a function of position of the sample in a waveguide, bulk lifetime can be determined. ***H. Jacobs, A. P. Ramsa, and F. A. Brand.*** *I.R.E. Proceedings*, v. 48, Feb. 1960, p. 229-233.

5546* The Application of Linear Servo Theory to the Design of AGC Loops. An analytical technique for designing automatic gain control (AGC) circuits is presented. It is directly applicable to high-gain high-performance radio receiving equipment. This technique permits the designer to specify the performance of the AGC system completely with respect to step changes in signal level, ramp changes in signal level, etc., before the receiver is constructed and tested. ***W. K. Victor and M. H. Brockman.*** *I.R.E. Proceedings*, v. 48, Feb. 1960, p. 234-238.

5547 Generalizations of the Concept of the Positive Real Function. The class k, subclass k, imaginary zeros of subclass k, some other tests for subclass k, double alternation for subclass k, and property of the phase functions of certain transfer functions are discussed. ***A. H. Zemanian.*** *IRE Transactions on Circuit Theory*, v. CT-6, no. 4, Dec. 1959, p. 374-383. (TK1 In6.6c Vis.)

5548 Microwaves in the Space Age. ***H. Richard Johnson.*** *IRE Transactions on Military Electronics*, v. MIL-4, no. 1, Jan. 1960, p. 5-10. (TK1 In6.6mi Vis.)

5549 A Radio-Astronomy Project at the University of Illinois. ***George C. McVittie.*** *IRE Transactions on Military Electronics*, v. MIL-4, no. 1, Jan. 1960, p. 14-18. (TK1 In6.6mi Vis.)

5550 Field Emission, A Newly Practical Electron Source. ***W. P. Dyke.*** *IRE Transactions on Military Electronics*, v. MIL-4, no. 1, Jan. 1960, p. 38-45. (TK1 In6.6mi Vis.)

5551 The ONR Program in the Electronics Research Laboratory of the University of California, Berkeley. ***Samuel Silver.*** *IRE Transactions on Military Electronics*, v. MIL-4, no. 1, Jan. 1960, p. 46-50. (TK1 In6.6mi Vis.)

5552 Communication Using Earth Satellites. ***Jerome B. Wiesner.*** *IRE Transactions on Military Electronics,* v. MIL-4, no. 1, Jan. 1960, p. 51-58. (TK1 In6.6mi Vis.)

5553 Control of Microwave Interference. Three types of spurious signals generated by microwave transmitters are discussed: splatter, harmonic radiation and anharmonic radiation; also the interference potentials and measurement problems of these types of radiation. ***Alden H. Ryan.*** *IRE Transactions on Radio Frequency Interference,* v. RFI-1, no. 1, May 1959, p. 1-10. (TK1 In6.6ra Vis.)

5554 Analysis of Through-Channel and Cross-Channel Insertion Loss in Ferrite-Wall Multiple-Circuit Feed Through Capacitors. Through-channel and cross channel insertion losses of a new type of multiple-circuit feed-through-capacitors, comprising ferrite walls and multiple ceramic-tubes, were calculated to aid in determining means for optimizing in design the characteristics in the VHF-UHF range. ***I. Melngailis, E. M. Williams, and J. H. Foster.*** *IRE Transactions on Radio Frequency Interference,* v. RFI-1, no. 1, May 1959, p. 11-17. (TK1 In6.6ra Vis.)

5555 Design of Quasi-Peak Detectors With Specified Time Constants. ***Yona Peless.*** *IRE Transactions on Radio Frequency Interference,* v. RFI-1, no. 1, May 1959, p. 18-25. (TK1 In6.6ra Vis.)

5556 The Mullard Radio Astronomy Observatory. Radio astronomy at Cambridge University has been extended by the establishment of a new observatory at which two large radio telescopes are already in use—one for the study of "radio star" and the other for low-frequency observations of the Milky Way. Both instruments use a new technique of "aperture synthesis" to enhance the resolving power, and the system and its application are described. ***M. Ryle.*** *Institution of Electrical Engineers, Journal,* v. 6, no. 61, Jan. 1960, p. 14-19.

5557* The Performance of a Balanced Aerial When Connected Directly to a Coaxial Cable. Measurements were made of the radiation patterns of typical aerials, such as would be used for domestic reception in the v.h.f. band, connected directly to a coaxial cable without the intervention of a balance/unbalance transformer. The vertical radiation pattern may be appreciably distorted, owing to the excitation of currents on the outside of the cable; and the sensitivity to vertically-polarized interference originating near to, and below the aerial, may be increased. ***G. D. Monteath.*** *Institution of Electrical Engineers, Proceedings,* v. 107, pt. B, no. 31, Jan. 1960, p. 21-25.

5558* Classes of 4-Pole Networks Having Non-Linear Transfer Characteristics But Linear Iterative Impedances. The rectangle representation of a planar circuit is briefly reviewed and its special application to non-linear circuits is explained. From simple geometrical symmetry of the rectangle diagrams it becomes immediately obvious that iterative structures may be constructed from dual non-linear resistive elements having linear iterative impedances. If these can be constructed practically, they might be connected in cascade, without mutual interaction, as non-linear equalizers analogous to Zobel's constant-resistance phase-equalizers. ***E. Colin Cherry.*** *Institution of Electrical Engineers, Proceedings,* v. 107, pt. B, no. 31, Jan. 1960, p. 26-30.

5559* Phase-Shift Keying in Fading Channels. The modest bandwidth requirements of p.s.k modulation suggest that it can not only alleviate spectrum crowding, but can also transmit traffic with fewer errors. The theoretical results presented here indicate, however, that the random phase perturbations inherent in fading radio signals cause unavoidable degradation in the performance of p.s.k. systems. ***H. B. Voelcker.*** *Institution of Electrical Engineers, Proceedings,* v. 107, pt. B, no. 31, Jan. 1960, p. 31-38.

5560* An Analysis of a Type of Comb Filter. Comb filters are useful for the selection or rejection of a train of uniformly spaced regular pulses. The response of the most suitable configurations to such a train of pulses and to a Gaussian noise input is investigated with particular reference to the improvement in signal/noise ratio possible with this type of filter. ***A. G. J. MacFarlane.*** *Institution of Electrical Engineers, Proceedings,* v. 107, pt. B, no. 31, Jan. 1960, p. 39-52.

5561* The Measurement of Atmospheric Radio Noise by an Aural Comparison Method in the Range 15-500 kc/s. Atmospheric noise received on a vertical aerial is compared with a locally-generated keyed signal to estimate the level at which the signal is 95% intelligible. This method was used in earlier high-frequency equipment and has been adapted for the range of 15-500 kc/s. The apparatus and its method of operation are described. ***J. Harwood and B. N. Harden.*** *Institution of Electrical Engineers, Proceedings,* v. 107, pt. B, no. 31, Jan. 1960, p. 53-59.

5562* An Experimental Investigation of a Two-Cavity Klystron Operating Under Large-Signal Conditions. Recent theoretical work on large-signal conditions has enabled some experimental results with large signals to be compared with calculations for similar, though not quite identical, conditions. Both the experiments and the theory show that the optimum drift length is considerably reduced when the input signal is large. ***I. M. Stephenson.*** *Institution of Electrical Engineers, Proceedings,* v. 107, pt. B, no. 31, Jan. 1960, p. 60-66.

5563* A Coaxial Film Bolometer for the Measurement of Power in the U.H.F. Band. Satisfies the requirements for all frequencies between 200Mc/s. Discusses the factors affecting its accuracy. The instrument can handle 2-200mW. ***I. A. Harris.*** *Institution of Electrical Engineers, Proceedings,* v. 107, pt. B, no. 31, Jan. 1960, p. 67-72.

5564* A Transistor Quadrature Suppressor for A.C. Servo Systems. The suppressor uses four low-power transistors and three indirectly heated thermistors. Two of the transistors form a pre-amplifier, and two operate in switched mode as a demodulator, driving two of the thermistor heaters differentially. ***I. C. Hutcheon and D. N. Harrison.*** *Institution of Electrical Engineers, Proceedings,* v. 107, pt. B, no. 31, Jan. 1960, p. 73-82.

5565* Fast Wave Couplers for Longitudinal Beam Parametric Amplifiers. The TWT equations are put in coupled mode form. A matrix formulation of these equations is used to point out a formal mathematical analogue of the Schrödinger equation of quantum mechanics. The design procedure for fast wave couplers is given in detail in a separate section. ***A. Ashkin, W. H. Louisell, and C. F. Quate.*** *Journal of Electronics and Control,* v. 7, no. 1, July 1959, p. 1-32.

5566* Tuning and the Equivalent Circuit of Multi-Resonator Magnetrons. The magnetron equivalent circuit is synthesized from its input admittance function which can be determined from the characteristics of a guide used to tune the magnetron. The equivalent circuit comprises as many LC branches as the amount of information provided by the tuning data. ***T. S. Chen.*** *Journal of Electronics and Control,* v. 7, no. 1, July 1959, p. 33-51.

5567* The Definition of Noise Factor When Applied to Systems Containing Negative Resistance Elements. The problems which arise in the interpretation and measurement of noise factor with the use of negative resistance elements are discussed. ***B. L. Humphreys.*** *Journal of Electronics and Control,* v. 7, no. 1, July 1959, p. 77-81.

5568* Ionospheric Absorption & Electron Collisional Frequency in the F Region. Total absorption of radio waves proceeding vertically upwards through the E layer and suffering reflection from the F layer was determined over a range of frequencies from nearly 3 to 7 Mc/s. by measuring the most probable values of the signal amplitudes of the first and second orders of ionospheric reflection. ***Y. S. N. Murty, R. N. Singh, and S. R. Khastgir.*** *Journal of Scientific & Industrial Research,* v. 18A, Nov. 1959, p. 507-509.

5569* Molecular & Allied Devices for Generation & Amplification of Microwaves. Reviews recent developments in molecular and allied devices for the generation and amplification of microwaves. Simple expositions of the principle of operation and representative experimental arrangements of the Maser and the Mavar type of devices are given. The possibilities of developing devices using plasma interaction and Cerenkov radiation are also briefly outlined. ***S. Deb and A. N. Daw.*** *Journal of Scientific & Industrial Research,* v. 18A, Nov. 1959, p. 510-519.

5570* Millimeters—The New Radio Frontier. The absorption of millimeter waves is due primarily to two constituents of the atmosphere. These are oxygen and water vapor. The Bell Telephone Laboratories have announced a transmission system using millimeter waves. By using a non-polar gas such as nitrogen in an oversize circular waveguide, the attenuation will be kept small. ***Archie W. Straiton and Charles W. Tolbert.*** *Microwave Journal*, v. 3, Jan. 1960, p. 37-39.

5571* Measurement of Varactor Quality. A varactor can be rated in terms of a Reactance/Resistance ratio at high microwave frequencies. A measurement, including case and mount losses, can be performed with ease and accuracy at 10,000 mc. ***Norman Houlding.*** *Microwave Journal*, v. 3, Jan. 1960, p. 40-45.

5572* Present State of Art in High Power Traveling-Wave Tubes. Perhaps the greatest impact within the next several years will be felt in the area of development and quantity production of high power TW tubes with life and reliability equivalent to existing low power microwave tubes. ***Ervin J. Nalos.*** *Microwave Journal*, v. 3, Jan. 1960, p. 46-52.

5573* Conference on Quantum Electronics. Beam masers, microwave and millimeter masers, parametric and ferromagnetic devices, optical pumping and optical masers, semiconducting and cyclotron resonance masers, and microwave ultrasonics are discussed. ***Benjamin Lax, editor.*** *Microwave Journal*, v. 3, Feb. 1960, p. 21 + 4 pages.

5574* Antenna Measurements. Theory and basic relations with patterns, effective length, the reciprocity theorem, the directivity, receiving cross section, elliptical polarization; practical considerations with types of antennas, signal levels and dynamic range, pattern range coordinates, citing considerations are discussed. ***J. Searcy Hollis.*** *Microwave Journal*, v. 3, Feb. 1960, p. 39-46.

5575* Ferroelectrics at Microwave Frequencies. Ferroelectrics now available can be useful in some microwave applications. New materials are being discovered and new combinations of old materials are being made. Wider application of ferroelectrics will be made as materials with improved Q and voltage sensitivity are found. ***W. J. Gemulla and R. D. Hall.*** *Microwave Journal*, v. 3, Feb. 1960, p. 47-51.

5576* Noise Temperature in Passive Circuits. At least three useful noise temperature expressions associated with passive components were discussed and their inter-relations derived. It is apparent that adequate systems computations are easily made when the losses and temperatures are known for passive components at uniform temperatures. The noise temperature concepts can also be used for propagating regions at non-uniform temperature. ***Henry H. Grimm.*** *Microwave Journal*, v. 3, Feb. 1960, p. 52-54.

5577 Investigations Into Redundancy and Possible Bandwidth Compression in Television Transmission. Three different aspects of redundancy present in normal television transmission are considered: (1) the statistical aspect, which is conceived with probability distributions of brightness, (2) the physiological aspect, which is conceived with the properties of the eye, (3) the psychological aspect, which is related to levels of consciousness. After this analysis of redundancy, transmission systems with narrow bandwidth are described in which bandwidth compression is effected by a decrease in the number of frames per second, viz., by decreasing the field frequency or the formation per field. ***K. Teer.*** *Philips Research Reports*, v. 14, no. 6, Dec. 1959, p. 501-556.

5578* Electronic Scanning Radar Systems. Electronic scanning is discussed in this paper as a means of attaining the high radar scanning rates necessary to track high-speed targets. The concepts of phase scanning, frequency scanning, and feed switching are weighed as alternatives to the mechanical positioning of a radar antenna. ***Kenneth E. Forsberg and Peter J. Kahrilas.*** *Sperry Engineering Review*, v. 12, no. 4, Dec. 1959, p. 2-9.

5579* Signal Flow and Scattering Techniques in Microwave Network Analysis. Presents a general composite method of analysis for microwave networks, combining the scattering matrix notation with signal flow graph techniques. Signal flow graph techniques are reviewed and applied to microwave network analysis, and the relationship between scattering and signal flow methods is established. ***Stuart B. Dunn and Gerald F. Ross.*** *Sperry Engineering Review*, v. 12, no. 4, Dec. 1959, p. 10-22.

5580 The Measurement of Thermionic Emission in Discharge Tubes. A new but simple procedure is described for measuring the zero-field emission I_s in gas-filled discharge devices. Probes are not used. The emission of oxide cathodes in fluorescent lamps is found by this technique to *increase* with increasing pressure of rare gas. The interpretation of this effect is that the rare gas retards the evaporation of Ba from the cathode and permits a higher equilibrium concentration of excess Ba in the cathode for a given rate of production. ***John F. Waymouth.*** *Sylvania Technologist*, v. 13, no. 1, Jan. 1960, p. 2-10.

5581 An Evaluation of the P-N-P-N Negative Resistance Diode. The operation of the three junction diode is analyzed and interpreted in terms of two contiguous transistors. It is seen that avalanche breakdown and the sum of the forward alphas determine the switching characteristics. The properties of four varieties of the diode are presented and comparisons made. A piecewise-linear equivalent circuit is developed. ***H. I. Honor.*** *U. S. Air Force, Cambridge Research Center, AFCRC-TR*-59-140, Mar. 1959, 36 pp. (TK7800 Un3.12b Contin.)

See also: **5972** (electron tube testing); **6121** (resins for component encapsulation).

ENGINEERING ECONOMICS

5582* Automating the Manufacturing Process. This is not basically a machine-focused book. The technical chapters are sufficient to bring to light the nature of the thinking that must be gone through by the team that will bring a machine to fruitful existence. It is an attempt to sharpen management's awareness of the kind of problems that confront this team; to reveal the sources of possible conflict within the team; and to emphasize to the creating group the fundamental difference between classical mechanical engineering and the problem of creating highly complex special-application machinery. ***George F. Hawley.*** 147 pp. 1959. Reinhold Publishing Corporation, New York. (TJ215 H31a)

5583* Can We Accelerate American Economic Growth? The author compares our growth with that of Western Europe and Russia, and explains merits and disadvantages of some proposed growth plans. ***Klaus E. Knorr.*** *General Electric Defence Quarterly*, v. 3, no. 1, Jan.-Mar. 1960, p. 4-10.

5584* Sound Economy and U. S. Defense. If our defense dollars are not spent wisely, the economy of the country can indeed be seriously threatened. ***Neil H. McElroy.*** *General Electric Defense Quarterly*, v. 3, no. 1, Jan.-Mar. 1960, p. 11-13.

5585* Are Our Sights Set High Enough? The defense budget will be challenged by rising costs. The higher challenge to technology is to enlarge its concept in a way that makes its objective not the weapon, but the mission. The mission problem must be considered in the context of the total defense posture. ***Thomas V. Jones.*** *General Electric Defense Quarterly*, v. 3, no. 1, Jan.-Mar. 1960, p. 14-17.

5586* One Way to Increase Procurement Efficiency—Quickly. Success in the defense business depends more upon the size of a firm's ideas, not the size of its capital investment. The nation needs both large and small defense contractors . . . and large and small contractors need each other. ***L. Berkley Davis.*** *General Electric Defense Quarterly*, v. 3, no. 1, Jan.-Mar. 1960, p. 18-22.

5587* The Role of Small Business. Time for small business to take a new look at its own valuation of its place in the defense market. ***Elliot E. Wentworth.*** *General Electric Defense Quarterly*, v. 3, no. 1, Jan.-Mar. 1960, p. 23-25.

5588* Marshalling Business to Meet the Communist Threat. A panel discussion by seven faculty members of the Harvard Business School in which the present and future role played by the U. S. is discussed. *General Electric Defense Quarterly*, v. 3, no. 1, Jan.-Mar. 1960, p. 26-35.

5589 When in Rome . . . The importance of understanding customs, manners, and mores in doing business abroad. ***Stefan Jean Rundt.*** *Management Review*, v. 49, Feb. 1960, p. 4-13.

5590 Sizing Up New Acquisitions. A Blueprint for the Expansion-Minded Company. In the final analysis, the success of a company's acquisition program will always result from the good business judgment of its management, not from adherence to a rigid set of rules. ***Robert G. Sproul, Jr.*** *Management Review*, v. 49, Feb. 1960, p. 28 + 12 pages.

5591 Product Planning: Key to Corporate Survival. Stresses the necessity of planning for the future by a constant search for profitable new products. *Management Review*, v. 49, Jan. 1960, p. 31-34.

5592* The Untold Story of the U. S. Budget. Yesterday's federal commitments are becoming the future's uncontrollable financial burdens. *Nation's Business*, v. 48, Mar. 1960, p. 31 + 3 pages.

5593* Consumers Will Ease Next Recession. A leading U. S. authority on consumers' behavior examines role of purchaser in control of future business downturns. ***George Katona.*** *Nation's Business*, v. 48, Mar. 1960, p. 34 + 2 pages.

5594* Put Competitors to Work for You. Here are new ideas for developing group effort and boosting productivity; your firm can profit by putting them to work. ***Charles A. Cerami.*** *Nation's Business*, v. 48, Mar. 1960, p. 38 + 3 pages.

5595 The Canadian Economy. Prospect and Retrospect. Explains the historical development of the Canadian economy in order to assess more accurately the importance and role of the casual factors which will shape Canada through the 1960's. The framework of the analysis can thus be used to up-date the specific projections as this becomes necessary in the future. ***Richard E. Caves and Richard H. Holton.*** 676 pp. 1959. Harvard University Press, Cambridge, Massachusetts. (HC111 C31c)

5596 How American Buying Habits Change. Gives concrete evidence of the rise in the standard of living found in the middle group of consumers in the U. S., from 1888 to the present time. *U. S. Bureau of Labor Statistics.* 253 pp. 1959. U. S. Government Printing Office, Washington, D. C. (HC106 Un3.4h)

5597 Coal-Chemical Materials Produced at Coke Plants in the United States 1948-57. Shows the economic importance of coal-chemical materials to coke-producing companies and illustrates trends in values, prices, and yields of coal-chemical materials during 1948-1957. ***Joseph A. DeCarlo and Maxine M. Otero.*** *U. S. Bureau of Mines Information Circular* 7925, 1959, 20 pp. (TN21 Un3i Vis.)

5598 Coke Plants in the United States on December 31, 1958. Tabular presentation shows the location, classification, number and type of ovens, annual coke capacity, coal chemicals produced, and name and address of parent company for each individual coke plant. ***Joseph A. DeCarlo and Maxine M. Otero.*** *U. S. Bureau of Mines Information Circular* 7934, 1959, 20 pp. (TN21 Un3i Vis.)

5599 Fuel-Briquetting and Packaged-Fuel Plants in the United States That Reported Production in 1958. Sixteen fuel-briquet plants and 23 packaged-fuel plants reported production in 1958. ***Eugene T. Sheridan and Virginia C. Berte.*** *U. S. Bureau of Mines Information Circular* 7935, 1959, 7 pp. (TN21 Un3i Vis.)

5600 Petroleum Refineries, Including Cracking Plants, in the United States, January 1, 1959. On January 1, 1959, the United States had 313 petroleum refineries with a total installed crude-oil throughput capacity of 9,819,846 barrels per day. ***C. E. Hennig.*** *U. S. Bureau of Mines Information Circular* 7937, 1959, 11 pp. (TN21 Un3i Vis.)

See also: **5634** (cost factors in industrial heating); **5642** (liquid oxygen economics); **5646** (coal reserves of Tennessee); **6035** (Canadian Zn industry—1958).

FLUID MECHANICS

5601* Hydraulic and Kinematic Pressure Characteristics for Unhomogeneous Dispersed Systems in Pipes. The effect movement of the liquid on particles having very small sizes compared with the depth of the flow, are determined by the Airy law. However, this law is not fulfilled for the smallest particles. *(In Russian.)* Gidravlicheskiye: Kinematicheskiye kharakteristiki dvizheniya heodnorodnykh dispersnykh sistem v trubakh. ***A. E. Smoldyrev.*** *Akademiia Nauk SSSR, Doklady*, v. 129, no. 5, 1959, p. 993-996.

5602 Effect of Aspect Ratio and Viscosity Gradients on Flow Through Open Channels. Pertains to glass tank operations. ***A. R. Cooper, Jr.*** *American Ceramic Society, Journal*, v. 43, Feb. 1960, p. 97-104.

5603* Anisotropic Fluids. Incorporates some features of the theory proposed by Oseen to describe the behavior of the so-called liquid crystals, but excludes a type of long-range interaction incorporated in this theory. ***J. L. Ericksen.*** *Archive for Rational Mechanics and Analysis*, v. 4, no. 3, 1960, p. 231-237.

5604 The Relation Between the Heat and Volume of Mixing. Equation relates the derivatives with respect to composition of ΔH and ΔV, where these are the differences of the molar heat and volume of the mixture and those of separated components. ***J. S. Rowlinson and A. R. Mathieson.*** *Chemical Society, Journal*, 1959, Dec., p. 4129-4130.

5605* Contribution to the Theory of Mass and Heat Transfer in a Turbulent Medium. ***V. Kolář.*** *Collection of Czechoslovak Chemical Communications*, v. 24, no. 12, Dec. 1959, p. 3811-3815.

5606 Aspects of the Statistical Thermodynamics of Real Fluids. Approximate expression has been determined for the work of creating a spherical cavity in a real fluid. Knowledge of this entity permits an evaluation of properties such as the surface tension and the normal heats of vaporization of fluids and the Henry's law constants of fluid mixtures. ***Howard Reiss, H. L. Frisch, and E. Helfand.*** *Journal of Chemical Physics*, v. 32, Jan. 1960, p. 119-124.

5607* Dynamic Mechanical and Creep Properties of a 23% Cellulose Nitrate Solution; Andrade Creep in Polymeric Systems. The N content of the polymer was 12.6% and its number-average molecular weight was 94,000. Dynamic mechanical measurements were made from −47 to 35 C within a frequency range of 0.06 to 2800 c.p.s. Creep runs were made from −33 to 25 C. Accompanying recovery measurements indicated that the system adhered to the Boltzmann superposition principle. ***Donald J. Plazek.*** *Journal of Colloid Science*, v. 15, no. 1, Feb. 1960, p. 50-75.

5608 Turbulence Drag Drastically Reduced. Missile, aircraft, torpedo and submarine speeds may be advanced through "porpoise-like" effect created by thin rubber skin on outer surfaces. ***John F. Judge.*** *Missiles and Rockets*, v. 6, no. 5, Feb. 1, 1960, p. 42-43.

5609* On a Method of Successive Approximations Applied to the Axisymmetric Flows of an Incompressible Perfect Fluid. The fundamental equation for the steady axisymmetric flow of an inviscid fluid is replaced with an approximate equation. The treatment of the proposed equation is very simple and its validity is ascertained by numerical calculations for the cases of a sphere and prolate spheroid for which exact solutions are already known. ***Tamedi Simasaki and Keishiro Niu.*** *Physical Society of Japan, Journal*, v. 14, Dec. 1959, p. 1810-1815.

5610 Rheology Theory and Applications. The normal-coordinate method for polymer chains in dilute solution, the principles of rheometry, viscosity of suspensions of electrically

charged particles and solutions of polymeric electrolytes, the rheology of latex, of printing inks, of pastes and paints, atomistic approach to the rheology of sand-water and of clay-water mixtures, the rheology of inorganic glasses, of concrete, the deformation of crystalline and cross-linked polymers, and other problems are discussed. ***Frederick R. Eirich, editor.*** v. III. 680 pp. 1960. Academic Press, New York. (QC189 Ei77r)

5611 Development of a Thin Film Heat-Transfer Gauge for Shock-Tube Flows. Liquid Pt paint for the manufacture of thin film resistance thermometers was investigated and films so made have been used. The response of this thin film to the hot gas flow generated in a shock tube was used to determine heat transfer rates using the results of classical heat conduction theory. ***B. W. Taylor.*** *Toronto University, Institute of Aerophysics, UTIA Technical Note No.* 27, June 1959, 34 pp. (TL570 T64.84t Vis.)

5612 Analysis of Turbulent Flow and Heat Transfer on a Flat Plate at High Mach Numbers With Variable Fluid Properties. *R. G. Deissler and A. L. Loeffler, Jr.* *U. S. National Aeronautics and Space Administration, Technical Report, NASA TR*-R-17, 1959, 33 pp. (TL521 Un3ra Vis.)

5613* Unsteady Motion of a Viscous Liquid Contained Between Two Infinite Coaxial Cylinders. The result is an extension of that given by Sneddon. Initially, the outer cylinder is rotating with constant angular velocity. When the steady state is attained, the inner cylinder is given an impulsive twist such that it also begins to rotate with constant angular velocity. ***C. D. Ghildyal.*** *Zeitschrift für Angewandte Mathematik und Mechanik*, v. 39, no. 12, Dec. 1959, p. 473-476.

5614* Flow of an Electrically Conducting Fluid Past a Porous Flat Plate in the Presence of a Transverse Magnetic Field. Exact solution has been obtained for the modified Navier-Stokes and Maxwell equations under the usual assumptions of magneto-hydrodynamics. The equation of heat transfer, including viscous and Joule dissipation, has been integrated. ***Anadi Shankar Gupta.*** *Zeitschrift für Angewandte Mathematik und Physik*, v. 11, no. 1, 1960, p. 43-50.

FOOD TECHNOLOGY

5615 Advances in Food Research. Rheology in food research; the blanching process and biochemistry of apple and pear fruits; micro-organisms in noncitrus juices; the chemical constituents of citrus fruits. Chemical changes associated with aging of meat, with emphasis on the proteins. v. VIII. ***E. M. Mark and G. F. Stewart, editors.*** v. IX. ***C. O. Chichester, E. M. Mark, and G. F. Stewart, editors*** v. VIII-IX. 437 and 395 pp. 1958-1959. Academic Press, New York. (TP370 Ad95 Vis.)

5616* Factors Influencing the Colour of Potato Chips. The fundamental browning which occurs during chipping is due to the reaction between amino acids and reducing sugars. Browning also occurs in the presence of amino acids and hydrolyzed sucrose. Evidence is presented to show that conditions favoring hydrolysis prevail during chipping but the extent to which it occurs, and the consequent browning, are dependent on the degree of acidity present during frying. ***L. R. Townsend and G. W. Hope.*** *Canadian Journal of Plant Science*, v. 40, no. 1, Jan. 1960, p. 58-64.

5617* Furcellaran, a Versatile Seaweed Extract. Describes uses of furcellaran in milk puddings, jams, jellies, marmalade, imitation jams and jellies, diabetic or dietetic products, meat or fish preservation, tooth paste, pharmaceuticals, appetite-reducing diets, culture medium, unboiled icing bases, bakers' jellies and as a bacteriocide. ***Ralph E. Schachat and Martin Glicksman.*** *Economic Botany*, v. 13, Oct.-Dec. 1959, p. 365-370.

5618 Free China's Big Protein Project. . . . yeast products from blackstrap molasses. ***H. C. Chien.*** *Food Engineering*, v. 32, Feb. 1960, p. 92-95.

5619* Improving Flavour, Colour and Texture. A survey of flavoring essences, flavor enhancers and seasonings, spices, colors, sausage additives, antioxidants, emulsifiers, and stabilizers. *Food Manufacture*, v. 35, Feb. 1960, p. 70-75.

5620* Heat Transfer in Hot Fat Cooking. The Smitherm system of indirect hot fat cooking is described. ***Horace L. Smith, Jr.*** *Food Technology*, v. 14, Feb. 1960, p. 84 + 4 pages.

5621* Problems in the Preparation and Handling of Hot Vended Canned Foods. *G. T. Peterson, J. F. Fox and L. E. Martin.* *Food Technology*, v. 14, Feb. 1960, p. 89-91.

5622* The Influence of Low Level Gamma Irradiation, Antibiotic Treatment, Storage Temperature and Vacuum Packaging on Flavor and Bacterial Changes in Cured Bacon. A combination method of preservation for extending the shelf life of meat products is described. ***W. L. Brown and M. L. Schmucker.*** *Food Technology*, v. 14, Feb. 1960, p. 92 + 1 page.

5623* Efficacy of Oxytetracycline for Aging Beef. . . . at elevated temperatures. Total surface bacteria, coliform, yeast, and mold counts were negligible after the carcasses were washed and sprayed with OTC and nystatin prior to aging. Counts increased during the aging period until processed but were not extensive enough to cause sliming and spoilage. Total bacteriological counts of the synovial fluid, excised popliteal lymph node and the *semimembranosus* increased slightly during aging but were not significant. ***R. B. Sleeth and H. D. Naumann.*** *Food Technology*, v. 14, Feb. 1960, p. 98-101.

5624* Comminuted Orange—a Novel Process for Its Manufacture. *J. B. S. Braverman and Aaron Levi.* *Food Technology*, v. 14, Feb. 1960, p. 106 + 3 pages.

5625* Preservative Effect of Some Antimicrobial Agents on High-Moisture Dried Fruits. Potassium sorbate and propylene oxide were found to be most effective. Potassium sorbate was found to have a residual effect in that treated prunes did not spoil in open packages. ***F. S. Nury, M. W. Miller, and J. E. Brekke.*** *Food Technology*, v. 14, Feb. 1960, p. 113-115.

FUELS AND COMBUSTION

5626 Composition of Reaction Mixture Flowing Through Rocket Nozzle. Simple procedure is developed which permits the prediction of near-frozen or near-equilibrium flow in rocket nozzles. ***R. P. Rastogi and T. P. Pandya.*** *ARS Journal*, v. 30, Jan. 1960, p. 63 + 2 pages.

5627 Interaction Between a Flame and a Shock Discontinuity. *G. D. Salamandra.* *ARS Journal*, v. 30, Jan. 1960, p. 73-76.

5628 Theory of Liquid Propellant Rocket Combustion Instability and Its Experimental Verification. *Luigi Crocco, Jerry Grey, and David T. Harrje.* *ARS Journal*, v. 30, Feb. 1960, p. 159-168.

5629* Limit Cases in the Burning of Solid Fuel-Oxidizer Mixtures. Shows that the curve of dependence of the velocity of combustion on the particle size for systems with an uninterrupted dividing line between the fuel and the oxidizer will be S-shaped; the curve will be shaped like a plateau for regular, unregulated mixtures in cases of very small particle sizes, but will be interrupted on sufficiently large particles. *(In Russian.)* Predel'nyye Sluchai Goreniya Smesevykh Sistem. ***N. N. Bakhman.*** *Akademiia Nauk SSSR, Doklady*, v. 129, no. 5, 1959, p. 1079-1081.

5630 Influence of Port Design and Gas Composition on Flame Characteristics of Atmospheric Burners. *J. C. Griffiths and E. J. Weber.* *American Gas Association, Research Bulletin* 77, Feb. 1958, 71 pp. (TP345 Am35r Vis.)

5631* The Pore Structure of Chars and Cokes. Brown coal chars were studied by density, surface area, and Hg penetration. ***A. Cameron and W. O. Stacy.*** *Australian Journal of Applied Science*, v. 10, no. 4, Dec. 1959, p. 449-457.

5632 Investigation of Carbonyl Groups in Solvent Extracts of Coals. ***P. H. Given and M. E. Peover.*** *Chemical Society, Journal*, 1960, Jan., p. 394-400.

5633* Detection and Determination of Manganese in Gasolines. A chemical method is described, based on the treatment of gasoline with Br followed by oxidation of extracted Mn to permanganate by means of KIO_4. Quantitative determination of Mn is accomplished spectrophotometrically at the wavelength of 520 mμ. Determination over the range of 0.03 to 0.3 gram of Mn per U. S. gallon, requires approximately two hours. *(In Italian.)* Riconoscimento e determinazione del manganese nelle benzine additivate. ***Mario Pedinelli.*** *Chimica e l'Industria*, v. 41, Dec. 1959, p. 1180-1184.

5634 Check All Cost Factors When Selecting Fuels . . . for Industrial Heating Systems. Factors that will apply to most sections of the U. S. and Canada, where heat is required in industrial areas for a substantial portion of the year are discussed. ***Charles Rand Steele.*** *Heating, Piping & Air Conditioning*, v. 32, Feb. 1960, p. 114-117.

5635* Prediction of the Coke Quality From the Composition of Coking Coal Blends of Medium- and Low-Volatile Coals. ***D. W. Van Krevelen, F. J. Huntjens, and A. H. Wilms.*** *Institute of Fuel, Journal*, v. 33, Jan. 1960, p. 3-9.

5636* Thermo-Gravimetric Studies of Coal and Model-Substances. ***J. A. Corrales and D. W. van Krevelen.*** *Institute of Fuel, Journal*, v. 33, Jan. 1960, p. 10-16.

5637* Combustion Research at Battelle. The Institute is now actively serving, and in the future will actively continue to serve all the energy industries in the conduct of research aimed at better serving the seemingly insatiable demands for energy of industry and the public. Areas of continuing interest which can be foreseen are related to further improvements and refinement of currently available equipment, fundamental studies to advance the state-of-the-art, and the development of an industrial technology based on much higher temperatures and reaction rates than those currently used. ***H. R. Hazard and A. A. Putnam.*** *Institute of Fuel, Journal*, v. 33, Jan. 1960, p. 22-31 + 8 plates.

5638 Some Recent Investigations Relevant to the Use of Town Gas in Industry. ***D. W. Gill and G. G. Thurlow.*** *Institution of Gas Engineers, Copyright Publication* No. 559, Nov. 1959, 37 pp. (TP700 In7.3c Vis.)

5639 Burning Rates of Solid Propellants. Burning mechanism of a solid propellant is described in terms of a pyrolysis law, a premixed laminar flame, and nothing more. ***Gerald Rosen.*** *Journal of Chemical Physics*, v. 32, Jan. 1960, p. 89-93.

5640* Coal Preparation—1959. Raw coal preparation, size reduction, sizing, cleaning, mechanical dewatering, thermal drying water clarification are discussed. ***Eugene R. Palowitch.*** *Mining Congress Journal*, v. 46, Feb. 1960, p. 54-56.

5641* Coal Research. I. Work carried on during the past year in the United States with regard to properties of coal, production, and preparation, utilization as a fuel, and conversion to another form prior to end use. ***John Mitchell and John C. Quinn.*** *Mining Congress Journal*, v. 46, Feb. 1960, p. 86-94.

5642 Lox Supply Stirs Industry Debate. Missile/space use generates $100 million business and takes 22% of nation's output. Air Products backs in-house production, Linde for commercial supply. ***Jay Holmes.*** *Missiles and Rockets*, v. 6, no. 8, Feb. 22, 1960, p. 24-27.

5643 Coker Can Handle High Carbon Stock. Appraises American Oil's delayed coking units. ***D. B. Meyer and J. C. Webb.*** *Petroleum Refiner*, v. 39, Feb. 1960, p. 155-158.

5644* The Position and Future of Coal as a Source of Power. The three phases of the history of coal since 1820 until now, the economic position on the energy market and the downward trend of natural gas were studied. Forecasts should not be too pessimistic because of slow replacement by other forms of energy and their long range exhaustion (oil) and because of the existence of exclusive fields covered by coal such as coal chemistry and coking. *(In French.)* La position et l'avenir du charbon dans l'économie énergétique. ***Paul Gardent.*** *Revue de l'Industrie Minerale*, v. 41, no. 11, Nov. 1959, p. 944-958.

5645* X-Ray Studies of Some Carbonized Coals. Results obtained from an X-ray examination of the carbonization products of certain vitrain coals after treatment at temperatures up to 1000 C. ***R. Diamond.*** *Royal Society of London, Philosophical Transactions*, v. 252, ser. A. Mathematical and Physical Sciences, no. 1008, Jan. 28, 1960, p. 193-223.

5646 The Coal Reserves of Tennessee. ***Edward T. Luther.*** *Tennessee, Division of Geology, Bulletin* 63, 1959, 294 pp. (TN21 T25.3b Vis.)

5647 A General Method for Automatic Computation of Equilibrium Compositions and Theoretical Rocket Performance of Propellants. ***Sanford Gordon, Frank J. Zeleznik, and Vearl N. Huff.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-132, Oct. 1959, 161 pp. (TL570 Un3t Vis.)

5648 Chemical Sampling Downstream of Lean, Flat Hydrogen and Propane Flames. ***Burton D. Fine.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-198, Dec. 1959, 25 pp. (TL570 Un3t Vis.)

5649 Heterogeneous Combustion of Multicomponent Fuels. Results indicate that during combustion the composition of a multicomponent fuel drop changes by a process of simple batch distillation. As burning proceeds the more volatile constituents of the liquid drop vaporize first and the concentration of the higher boiling fractions in the liquid phase increases. ***Bernard J. Wood, Henry Wise, and S. Henry Inami.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-206, Nov. 1959, 32 pp. (TL570 Un3t Vis.)

See also: **5150** (hydrogen liquefaction); **5187** (coal preparation plant slurries); **5597** (coal chemical materials); **5598** (coke plants in U. S.); **5599** (fuel-briquet and packaged-fuel plants); **5600** (petroleum refineries in U. S.); **5692** (petroleum technology, review).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

5650 Results of Scientific Investigations Made by Soviet Sputniks and Cosmic Rockets. ***V. I. Krasovskii.*** *ARS Journal*, v. 30, Jan. 1960, p. 27-33.

5651 The Origin of Continents, Mountain Ranges, and Ocean Basins. The continents and mountain ranges do not represent extra loads of rock superimposed upon the Earth's crust, but are masses of lighter rock floating in a denser substrate. Much geological evidence indicates that the ancient continents were in approximately the same place as the present continents and that continents have existed more or less as they are today and for a period of at least two billion years. ***George C. Kennedy.*** *American Scientist*, v. 47, no. 4, Dec. 1959, p. 491-504.

5652* A Method for the Investigation of the Distribution of Meteoric Bodies According to Mass. Method enables the distribution of meteoric bodies according to mass to be studied, the distribution of meteor radio echoes of a stable type according to duration being used. Gives results of the application of this method to the Perseid stream. *(In Russian.)* Metod issledovaniia zakona raspredeleniia meteornykh tel po Massam. ***E. I. Fialko.*** *Astronomicheskii Zhurnal*, v. 36, no. 6, Nov.-Dec. 1959, p. 1058-1060.

5653* Secular Perturbations in the Theory of Motion of an Artificial Earth Satellite. The problem is considered in the first approximation, taking into account the flattening of the earth and air resistance. The model of the atmosphere, proposed by D. E. Ohotsimsky, T. M. Yeneyev and G. P. Taratynova, was used for deriving the secular perturbations due to air resistance. The secular perturbations of the elements of the orbit in 1958 β_2 were found from the obtained formulas. *(In Russian.)* O Vekovykh vozmushcheniiakh v teorii dvizheniia iskusstvennykh sputnikov zemli. ***E. A. Grebenikov.*** *Astronomicheskii Zhurnal,* v. 36, no. 6, Nov.-Dec. 1959, p. 1111-1121.

5654 A Review of Foothills Drilling. Discusses foothills drilling problems based mainly on experiences in Western Canada. ***A. D. Jones.*** *Canadian Mining and Metallurgical Bulletin,* v. 53, no. 573, Jan. 1960, p. 30-34.

5655* Petrology of the Fountain and Lyons Formations, Front Range, Colorado. Interprets the sedimentary history of the Permo-Pennsylvanian Fountain and Permian Lyons Formations based on the stratigraphy, lithology, and petrography of these rocks along the Colorado Front Range from Eldorado Springs to Colorado Springs. ***John F. Hubert.*** *Colorado School of Mines, Quarterly,* v. 55, no. 1, Jan. 1960, 242 pp.

5656* Some Geophysical and Astronomical Observations, Performed From a Balloon in the Stratosphere. *(In French.)* Quelques observations géophysiques et astronomiques effectuées en ballon dans la stratosphère. ***Audouin Dollfus.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 249, no. 23, Dec. 9, 1959, p. 2602-2604.

5657* Exploiting the Oceans: Industry's Next Frontier. *Dun's Review and Modern Industry,* v. 75, no. 2, Feb. 1960, p. 55 + 3 pages.

5658* The Electrical Sandstorm and Similar Phenomena. The effects of electrical discharges on human beings, depending on the voltage and the energy involved, are described. Comparative figures give information on the frequency of the occurrence of deaths by lightning strokes in Bavaria and Sweden during the last 25 years. The physical mechanism of electrical charging phenomena in sandstorms, dust storms and volcanic eruptions are investigated in detail. A review of the frequency of occurrence of thunderstorms in various parts of the world and its relation to the extent of land covering the meridians and the daily variations of the electrical field strength, concludes the article. *(In German.)* Der elektrische Sandsturm und verwandte Erscheinungen. ***Dietrich Müller-Hillebrand.*** *ETZ: Elektrotechnische Zeitschrift,* v. 80, Ausgabe A, no. 24, Dec. 11, 1959, p. 837-844.

5659* Structures Don't Settle in This Shale; but Watch Out for Heave. It is believed that pyrite in shale oxidizes, expands, and splits the shale. *Engineering News-Record,* v. 164, no. 5, Feb. 4, 1960, p. 46-48.

5660* Method for the Determination of the Ratio of Oxygen Isotopes in Rocks and Minerals. A method for the reduction of rocks and minerals by graphite for the purpose of isotopic analysis of their O is described. The co-action of rock and mineral reduction by graphite is completed within 15-18 minutes in the temperature interval from 1000 to 1900 C. The applicability of the method of investigation is shown. *(In Russian.)* Metod opredeleniya sootnoshenii izotopov kisloroda v gornykh porodakh i mineralakh. ***E. I. Dontsova.*** *Geokhimiia,* 1959, no. 8, p. 669-678.

5661* Contribution to the Petrochemistry of Ultrabasic Rocks. The genetic groups of ultrabasic rocks: hypermagbasites–derivatives of the peridotitic layer of the earth (Sima), ultraferbasites–differentiates of the gabbroic magma (Sialma), and ultra-albasites–differentiates of the magma of alkaline gabbroids (Sialma), as well as stony meteorites, have their definite numeral characteristics. *(In Russian.)* K petrokhimii ul'traosnovnykh gornykh porod. ***N. D. Soboler.*** *Geokhimiia,* 1959, no. 8, p. 679-695.

5662 The Role of Radar in Space Research. ***K. J. Craig, A. Shapiro, and B. S. Yaplee.*** *IRE Transactions on Military Electronics,* v. MIL-4, no. 1, Jan. 1960, p. 11-14. (TK1 In6.6mi Vis.)

5663 Industrial Minerals and Rocks. Abrasives; barium minerals; borax and borates; cement materials; gem stones and allied materials; graphite; lime; mineral fillers; phosphates; sand and gravel. ***Joseph L. Gillson, et al., editors.*** 3rd Ed. 934 pp. 1960. The American Institute of Mining, Metallurgical, and Petroleum Engineers, New York. (TN145 Am35i3)

5664 Pressure Storage of Town Gas in a Prepared Underground Cavity. The functions of storage capacity; optimum storage capacity; compression and control of stored gas. ***E. Crowther.*** *Institution of Gas Engineers, Copyright Publication No.* 558, Nov. 1959, 29 pp. (TP700 In7.3c Vis.)

5665* Classes of Metallic Complexes in Petroleum. Nickel and V analysis; analysis for free porphyrins; separation of metals from oil and its fractions; calculation of results. ***W. Warren Howe and Arthur R. Williams.*** *Journal of Chemical and Engineering Data,* v. 5, no. 1, Jan. 1960, p. 106-110.

5666* The Skew Frequency Distributions and the Fundamental Law of the Geochemical Processes. ***Andrew B. Vistelius.*** *Journal of Geology,* v. 68, no. 1, Jan. 1960, p. 1-22.

5667* Magnitude and Frequency of Forces in Geomorphic Processes. ***M. Gordon Wolman and John P. Miller.*** *Journal of Geology,* v. 68, no. 1, Jan. 1960, p. 54-74.

5668* Geomagnetic Effects on Cosmic Radiation for Observation Points Above the Earth. ***Joseph E. Kasper.*** *Journal of Geophysical Research,* v. 65, no. 1, Jan. 1960, p. 39-53.

5669* Electrical Theory of Tornadoes. Suggests that there is sufficient electrical energy in an intense thunderstorm to power a tornado and that the electrification could cause winds by electrically heating air or by accelerating charged air in an electric field. ***Bernard Vonnegut.*** *Journal of Geophysical Research,* v. 65, no. 1, Jan. 1960, p. 203-212.

5670* On the Statistical Prediction of Ocean Temperatures. There is practically no relation between radiation and sea-surface temperature, but there is a noticeable but small relation between wind and temperature. ***Gunnar I. Roden and Gordon W. Groves.*** *Journal of Geophysical Research,* v. 65, no. 1, Jan. 1960, p. 249-263.

5671* Down-Hole Injection of Butane to Control Paraffin Deposition in Pumping Wells. ***Charles O. Lukehart.*** *Journal of Petroleum Technology,* v. 12, Jan. 1960, p. 14-16.

5672* Profitable Application of Well Logs. Quantitative data to be determined from long analyses are formation porosity, fluid saturation, and formation water resistivity. ***J. E. Kirby, Jr., R. C. Culver, and J. B. Mattei.*** *Journal of Petroleum Technology,* v. 12, Jan. 1960, p. 17-22.

5673* Production Behavior of a Water-Blocked Oil Well. A mathematical study of radial two-phase flow, neglecting capillary effects, was employed to study the formation of such a water block and subsequent removal by production from the well. ***K. H. Ribe.*** *Journal of Petroleum Technology,* v. 12; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 219, Jan. 1960, p. 1-6.

5674* Gravity Drainage of Oil Into Large Horizontal Fractures. Investigation of the production of oil through horizontal fractures of high capacity and large radius placed at the base of producing formations. ***T. E. Morrisson and James H. Henderson.*** *Journal of Petroleum Technology,* v. 12; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 219, Jan. 1960, p. 7-15.

5675* Operation Mohole. A project is now being planned to drill a hole completely through the oceanic crust to obtain samples of the mantle–probably to a depth of 30,000 ft. Coring, testing, temperature, drilling, and other problems are discussed. The available equipment and drilling cost are also discussed. ***Willard Bascom.*** *Mines Magazine,* v. 50, Feb. 1960, p. 15-19.

5676* The Place of Geology in the Development of the Mining Industry. An aid to mining in the transition period, scope of USGS, research during the survey, possibilities for ore deposits, new mining and milling methods, recovery of

metals as by-products, and other problems are discussed. ***Thomas B. Nolan.*** *Mines Magazine,* v. 50, Feb. 1960, p. 20-22.

5677* Mining Geology. Study of basic geological problems in order to better understand how ore deposits are formed. Only through comprehensive knowledge of the distribution of elements in the earth's crust can intelligent exploration succeed in finding new ore deposits to supply the raw materials of an expanding industrial economy. ***C. A. Anderson.*** *Mining Congress Journal,* v. 46, Feb. 1960, p. 38-41.

5678* Industrial Minerals Reflect Brisk Activity in the Construction Industry. Mining of asbestos, barite, beryl, B, clay, diamonds, crushed and broken stone, fluorspar, gypsum, Li, mica, salt, soda ash, talc, soapstone, pyrophyllite, and other minerals is discussed. ***Richard M. Foose.*** *Mining Congress Journal,* v. 46, Feb. 1960, p. 70-75.

5679* Uranium. Activities in 1959. ***A. M. Mastrovich.*** *Mining Congress Journal,* v. 46, Feb. 1960, p. 102-107.

5680 Explosions Research Applied to Mine and Quarry Blasting. ***Clifton W. Livingston.*** *Mining Engineering,* v. 12, Jan. 1960, p. 29-30.

5681* A Record of Progress in Mining, Metallurgy, and Geology. Heavy minerals from Natal beach sands; bead test for U; Fe ore in Ungava. *Mining Magazine,* v. 102, no. 1, Jan. 1960, p. 53-57.

5682* Belgian Congo. II. Modern mining operations in Belgian Congo are described. Copper, Co, and other metals are obtained. *Mining World,* v. 22, no. 2, Feb. 1960, p. 34-37.

5683 Interferrometric Studies on Synthetic Diamonds. ***S. Tolansky and I. Sunagawa.*** *Nature,* v. 185, Jan. 23, 1960, p. 203-204.

5684 Low-Energy X-Rays From Interplanetary Space. ***L. Reiffel.*** *Nature,* v. 185, Jan. 23, 1960, p. 229.

5685 Presence of Carbohydrates and Other Organic Compounds in Ancient Sedimentary Rocks. ***J. G. Palacas and F. M. Swain.*** *Nature,* v. 185, Jan. 23, 1960, p. 234.

5686 New Weight Indicator Gives Hook Load and Total Load on Mast. Hydraulic unit operates under derrick legs, with indicator in full view of driller. Even wind load on the mast is shown. ***W. B. Bleakley and Robert J. Enright.*** *Oil and Gas Journal,* v. 58, no. 7, Feb. 15, 1960, p. 100-104.

5687 Distribution of Infrared Radiance Over a Clear Sky. Series of measurements of the distribution of radiance over a clear sky made from locations at approximately 1000, 6000, and 14,000 ft. elevation are reported. A theoretical relation is shown to correctly predict the observed variation in radiance with elevation angle in the 2-40 μ wavelength region, where radiation from the sky is mainly due to thermal emission by the atmosphere. ***H. E. Bennett, Jean M. Bennett, and Max R. Nagel.*** *Optical Society of America, Journal,* v. 50, Feb. 1960, p. 100-106.

5688 Fundamentals of Electric Logging. IV. Developments in electric logging practices provide data needed for location, evaluation, and production of petroleum reservoirs. ***W. P. Biggs.*** *Petroleum Engineer,* v. 32, Feb. 1960, p. B26-B34.

5689 A New Tool for the Measurement of . . . Gel Development in Drilling Fluids. Presents a possible means for determining yield point of drilling muds and measuring rate of development of gel strength. ***F. W. Jessen and Can Naci Toktar.*** *Petroleum Engineer,* v. 32, Feb. 1960, p. B48 + 3 pages.

5690* Determination of the Physical Parameters of Oil-Bearing Rocks for Calculation of Oil Reserves in Deposits According to Electrometric and Radiometric Data. ***F. I. Katyakhov.*** *Petroleum Geology,* v. 2, no. 10-B, 1958, p. 879-883.

5691 Cosmogenic Rare Gas Contents of Iron Meteorites. A sample is slowly vaporized out of an Al crucible inductively heated by a surrounding Mo cup. Impurity gases from O, H, and C in the metal are formed by the high temperature, and removed. After the sample is prepared, it is expanded into the mass spectrometer and measured. A standard amount of the rare gases is then added by a gas pipette and the sample is measured again. ***Oliver A. Schaeffer.*** *Physics Today,* v. 13, Feb. 1960, p. 18-22.

5692 Reviews of Petroleum Technology. Geology and regional developments; refining processes and plant; crude petroleum and its products; and petroleum industry trends. ***E. B. Evans, D. L. Samuel, and George Sell, editors.*** v. XIV. 232 pp. 1955. The Institute of Petroleum, London. (TN860 In7p Vis.)

5693* Some Recent Progress in Air Survey With Particular Reference to Newly-Developed Territories. Progress in aerial surveying cameras; aircraft, and navigational methods; some applications of the photograph: geology, forests, and agriculture; air survey as applied to mapping: some uses in newly developing areas; airborne electronic aids designed to reduce the need for ground framework control; airborne geophysical survey as an aid to mineral prospecting. ***W. P. Smith.*** *Royal Aeronautical Society, Journal,* v. 64, Jan. 1960, p. 1-23.

5694* Satellites and Radio Astronomy. Discusses the possible uses of the satellite in "far" radio wave investigations. ***W. L. Rae.*** *Spaceflight,* v. 11, no. 5, Jan. 1960, p. 137-139.

5695* The N.A.S.A. Space Sciences. II. Objectives; present knowledge; existing problems; program. *Spaceflight,* v. 11, no. 5, Jan. 1960, p. 143-146.

5696* Arizona Solar Research Center in Operation. ***Raymond W. Bliss, Jr.*** *Sun at Work,* v. 4, no. 3, Sept. 1959, p. 4-5.

5697 The Undiscovered Earth. A series of twelve papers for layman and specialists. 56 pp. 1959. Southern Research Institute, Birmingham, Alabama. (QE501 So88u)

5698 Summary of Rawinsonde Measurements of Temperatures, Pressure Heights, and Winds Above 50,000 Feet Along a Flight-Test Range in the Southwestern United States. ***Terry J. Larson and Harold P. Washington.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-*D-192, Jan. 1960, 80 pp. (TL570 Un3t Vis.)

5699* Photogeology Giving Rapid Coverage in Four Corners. Oil and mining companies, AEC benefit from good aerial geologic evaluation; color is effective. ***Marshall S. Wright, Jr.*** *World Oil,* v. 150, Feb. 1960, p. 104-107.

5700* What's New in Drilling. Air and gas drilling, new percussion drill, continuous cores, new drives for drilling, formation testing, portability for drilling rigs are discussed. *World Oil,* v. 150, Feb. 1960, p. 130 + 5 pages.

5701* Tritium and Deuterium Content of Atmospheric Hydrogen. The tritium and deuterium content of 24 samples of atmospheric H collected at ground level near Buffalo, N. Y. (U.S.A.), Hamburg (Germany), and Nürnberg (Germany) during 1954 to 1956 was measured. ***Friedrich Begemann and Irving Friedman.*** *Zeitschrift für Naturforschung,* v. 14a, Dec. 1959, p. 1024-1031.

See also: **5026** (astrophysics); **5186** (vibration mills); **5646** (coal reserves of Tennessee).

GRAPHIC ARTS

5702* Phototypography as an Integrated Process. I. The planning and execution phases of the process of phototypography are discussed. ***Carl P. Palmer.*** *Graphic Arts Monthly,* v. 32, Feb. 1960, p. 23 + 4 pages.

5703* Color. Seminar at RIT Discusses Color Vision, Light Sources and Ways of Making Comparisons and Specifying Colors. Excerpts from a Color and Color Control Seminar sponsored late last year by Rochester Institute of Technology. The excerpts are taken from a full report of the

seminar prepared by Warren L. Rhodes of RIT. ***S. M. Hewhall, et al.*** *Modern Lithography*, v. 28, Feb. 1960, p. 32 + 3 pages.

5704* **Some Tips on Camera-Back Masking. I.** General requirements, testing filters and lenses, register, film placement, color patches, checking masks are discussed. ***Edward Glauder.*** *Modern Lithography*, v. 28, Feb. 1960, p. 65 + 2 pages.

5705 **Analytical Densitometry for Color Print Evaluation.** For a wide gamut of dye combinations for a reflection print material, equivalent neutral densitometry is shown to compare favorably with colorimetric measurements for the evaluation of color prints. Over a limited range of normal printing conditions, there is a linear relation between reflection density and distance from the illuminant point along the vectors of a colorimetric dye grid. ***Judith W. Onley.*** *Optical Society of America, Journal*, v. 50, Feb. 1960, p. 177-182.

5706* **Relief Printing by Thermography.** Describes improved equipment, supplies and production techniques. ***Erwin S. Koval.*** *Printing Magazine*, v. 84, no. 2, Feb. 1960, p. 52 + 4 pages.

See also: **5744** (aerial photography); **5760** (lubrication of printing equipment); **6012** (photographic study of elementary particles).

HEAT POWER

5707 **Measurement of the Speed of Propagation of Turbulent Combustion.** ***K. I. Shchelkin.*** *ARS Journal*, v. 30, Jan. 1960, p. 76-77.

5708 **Experimental Investigation of Propellant Erosion.** Erosion test methods, characterized by separate gas producing charges and separate specimens in the gas stream, are described. Changing the temperature of the gas stream over a propellant specimen from 1690 to 2550 K did not seem to influence the erosion at constant gas velocity and pressure. ***Tage Marklund and Arne Lake.*** *ARS Journal*, v. 30, Feb. 1960, p. 173-178.

5709* **Graphical Analysis of Transient Pressure and Velocity Changes in the Fuel Injection Systems of Diesel Engines.** ***Kálmán J. de Juhás z.*** *Acta Technica Academiae Scientiarum Hungaricae*, v. 27, nos. 1-2, 1959, p. 53-64.

5710 **Advanced Aero Engine Testing.** Covers engine test facilities, engine component testing, and flight test problems under simulated flight conditions of pressure, temperature, and velocity. ***A. W. Morley and Jean Fabri, editors.*** 298 pp. 1959. Pergamon Press, New York. (TL701.8 N81.1a)

5711* **A Cold Turbine Ejector Engine.** A new form of gas turbine engine, in which the turbine is relieved of high gas temperatures, is proposed. Protective rights have been filed by a major aero engine manufacturer. ***L. G. Cramp.*** *Aeronautics*, v. 41, no. 4, Feb. 1960, p. 38-39.

5712 **Balancing Thrust in Separate Turbine Elements.** Opposed steam flow design reduces diameters of rotating elements in the high temperature region of large turbines. ***C. D. Wilson.*** *Allis-Chalmers Electrical Review*, v. 24, no. 4, 1959, p. 16-19.

5713 **Edroc—Educational Rocket Motor.** Classroom demonstration unit and accompanying text offer teacher and student a basis for a beginning astronautics course. ***Richard Hanbicki.*** *Astronautics*, v. 5, Feb. 1960, p. 43 + 1 page.

5714 **Plug Nozzle Rockets Show Space, Missile Promise.** Advantages claimed include: segmented engine, which allows combining of cells to achieve engines of any desired thrust level. Better performance below the design pressure ratio. *Aviation Week*, v. 72, Feb. 1, 1960, p. 16-19.

5715* **Energy Diagrams for Combustion Gases.** To facilitate thermal calculations with energies, simple formulae are presented for the calculation of the energy of fuels from the calorific value. *(In German.)* Exergiediagramme für Verbrennungsgase. ***Zoran Rant.*** *Brennstoff-Wärme-Kraft*, v. 12, Jan. 1960, p. 1-8.

5716* **Symposium on Multi-Fuel Engines.** Contains seven separate papers on gasoline engines and engine design. *Gas and Oil Power*, v. 54, no. 659, 1959, p. 335-348.

5717* **The Use of Solar Energy as Heat Source for a Heat Pump.** Combination of the heat pump with solar heaters and accumulators of limited size has considerable advantage. Application in the southern parts of the U.S.S.R. for the heating of buildings, and cooling of air, is feasible. *(In Russian.)* Ispol'zonvanie solnechnoĭ energii v kachestve istochnika tepla dlia teplovogo nasosa. ***G. Ratiani, R. Khuntsariia, and O. Turkestanishvili.*** *Kholodil'naia Tekhnika*, v. 36, no. 6, Nov.-Dec. 1959, p. 17-19.

5718* **Nuclear Marine Propulsion in Russia, France and Japan.** ***J. R. Finniecome.*** *Mechanical World and Engineering Record*, v. 140, Jan. 1960, p. 30-33.

5719 **Paley Report Series—No. 4. Current Trend of Production and Consumption of Sources of Energy.** ***Eugene Ayres.*** *Mining Engineering*, v. 12, Jan. 1960, p. 38-40.

5720 **Storables Stir Renewed Interest.** Report on storable propellants for large rocket vehicles. ***C. M. Beighley.*** *Missiles and Rockets*, v. 6, no. 7, Feb. 15, 1960, p. 30-33.

5721* **Progress in Developing Solar Batteries.** ***Cyril Hilsum.*** *New Scientist*, v. 7, Jan. 14, 1960, p. 96-99.

5722* **What Lube Oil Analysis Can Tell You About Engines.** Practical tool for preventive engine maintenance. ***W. E. Scruggs.*** *Pipe Line News*, v. 12, Feb. 1960, p. 40-45.

5723* **Liquid-Metal Heat Exchangers.** ***Robert A. Tidball.*** *Power*, v. 104, Feb. 1960, p. 82-85.

5724* **New Energy Conversion Techniques for Space Vehicles.** New techniques will get the lion's share of research and development effort, reports the Power Division WADC. ***Richard Ling.*** *SAE Journal*, v. 67, Dec. 1959, p. 56-57.

5725* **Reaction Front and Pressure Rise Rates Measured Simultaneously in Spark Ignition Engines.** ***E. S. Starkman, F. M. Strange, and T. J. Dahm.*** *SAE Journal*, v. 67, Nov. 1959, p. 73-77.

5726* **British Turbine Engine Review.** ***W. A. Pennington.*** *Shell Aviation News*, 1959, no. 258, Dec., p. 14-20.

5727* **The Properties of a Copper Oxide-Aluminum Selective Black Surface Absorber of Solar Energy.** Shows that the Al base must be highly reflective, the spray solution must be dilute, the droplets must be small, and the spray rate must be kept below the point of incipient visible wetting of the sprayed hot plate. ***H. C. Hottel and T. A. Unger.*** *Solar Energy*, v. 3, no. 3, Oct. 1959, p. 10-15.

5728* **Solar Power Converters.** The major detriment to increased application of the photovoltaic cell is economic. Although the cost has recently been reduced by a factor of almost an order of magnitude, it is still prohibitively high for most applications. ***Irving Wolff.*** *Solar Energy*, v. 3, no. 3, Oct. 1959, p. 36-37.

5729* **Rocket Nozzles and Exhaust Jets.** ***E. T. B. Smith.*** *Spaceflight*, v. 11, no. 5, Jan. 1960, p. 151-154.

5730 **Using Pulsating Gas Stream in Turbochargers.** Formulas were derived concerning the efficiency of gas turbines used as driving units in turbojets charging internal combustion engines. The conditions for optimum relation between the turbocharger and the engine were surveyed. The unsteady character of the gas stream is expressed by means of the changing Reynolds and Mach numbers. On this basis the shape of blades was determined. *(In Czech.)* Využiti pulsačního proudu v turbině přeplňovaciho dmychadla. ***J. Jerie and V. Kačer.*** *Strojírenství*, v. 9, no. 12, Dec. 1959, p. 895-901.

5731* **New Constructions of Steam Boilers for High and Superhigh Steam Parameters.** Review of home-made high capacity steam boilers and their elements according to the

data presented by "Krasny Kotelschik" works and the decisions of technical committees of the Rostov and the Moscow councils of national economy and the Ministry of power station construction. *(In Russian.)* O novykh konstruktsiiakh parovykh kotlov na vysokie i sverkhvysokie parametry para. ***K. F. Roddatis.*** *Teploenergetika*, v. 7, no. 1, Jan. 1960, p. 3-13.

5732 Evaluation of Designs and Materials for High Speed-High Temperature Shaft Seals for Turbojet Engine Applications. ***John J. Brenza, John H. Fuchsluger, Glenn F. Hyde, and Ernest J. Taschenberg.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 56-267, Dec. 31, 1958, 88 pp. (TL570 Un3.18w Vis.)

5733 Control of Combustion-Chamber Pressure and Oxidant-Fuel Ratio for a Regeneratively Cooled Hydrogen-Fluorine Rocket Engine. System proved capable of starting a H-F rocket engine, providing stable operation to within ±2% of the preset values of chamber pressure and mixture ratio, and limiting transient deviations in oxidant-fuel ratio sufficiently to avoid a stoichiometric mixture. ***Edward W. Otto and Richard A. Flage.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-82, Nov. 1959, 61 pp. (TL570 Un3t Vis.)

5734* Design Features of Jet Power Units. II. Apart from turbojet propulsion units, turbojet engines with regeneration are steadily gaining in importance, in that they enable specific fuel consumption to be reduced to less than 0.7 kg/kphr. Nuclear powered jet units are still in an early stage of development. Applications indicate that gas-turbine powered jet propulsion units are likely to retain their position for some time to come. *(In German.)* Konstruktionsmerkmale von Strahltriebwerken. II. ***Karl Leist.*** *VDI Zeitschrift*, v. 101, no. 36, Dec. 21, 1959, p. 1775-1781.

5735* Considerations Contributing to the Explanation of Ramjets. Based upon the knowledge of the losses occurring in a ramjet, diagrams are presented with regard to the conditions which are important for the intake and the flow in the combustion chamber. From these diagrams, conclusions can be drawn concerning the dependence of engine data on flight Mach number, pressure recovery and operating temperature. *(In German.)* Betrachtungen zur Auslegung von Staustrahltriebwerken. ***Hermann Hagen.*** *Zeitschrift für Flugwissenschaften*, v. 8, Jan. 1960, p. 17-22.

See also: **5009** (propulsion systems for space vehicles); **5627** (shock discontinuity and flame behavior).

INFORMATION—PREPARATION AND DISSEMINATION

5736 The Mathematical Foundations of Bibliographic Organization. Knowledge and information are explained in mathematical terms. The properties of bibliographic organization and mathematics are combined to indicate that bibliographic organization is a form of mathematics. ***Thomas Minder.*** *American Documentation*, v. 11, no. 1, Jan. 1960, p. 2-8.

5737 Information Gathering Patterns and Creativity. A Study of Research Chemists in an Industrial Research Laboratory. A comparison of creative and "noncreative" research chemists with respect to the ways in which they use their professional and technical literature. Creative research chemists make significantly different use of the technical literature, in both quantity and depth of use, from that of less creative research chemists. ***Robert E. Maizell.*** *American Documentation*, v. 11, no. 1, Jan. 1960, p. 9-17.

5738 The "Half-Life" of Some Scientific and Technical Literatures. A consideration of the analogy between the *half-life* of radioactive substances and the rate of obsolescence of scientific literature. ***R. E. Burton and R. W. Kebler.*** *American Documentation*, v. 11, no. 1, Jan. 1960, p. 18-22.

5739 Electronic Transmission for Interlibrary Loans. A consideration of the economic and technical problems relating to facsimile and other forms of electronic transmission as a substitute for interlibrary loans. ***Ellis F. King.*** *American Documentation*, v. 11, no. 1, Jan. 1960, p. 32-39.

5740 Training of Patent Abstracters for Chemical Abstracts. A description of the training program used at the Chemical Abstracts Service for preparing abstracters to work in the peculiarly difficult field of abstracting patents while keeping in mind the needs of the chemist rather than those of the lawyer or patent examiner. Important success in improving the quality of the abstracts and increasing the period of service of the abstracters are claimed for this program. ***Gerard O. Platau.*** *American Documentation*, v. 11, no. 1, Jan. 1960, p. 40-43.

5741 Soviet Bibliographical Projects. Achievements in the USSR, Assessment in the USA. The aim of this paper is to discuss two sources which are *bibliographies of retrospective bibliographies.* ***Elizabeth Beyerly.*** *American Documentation*, v. 11, no. 1, Jan. 1960, p. 44-54.

5742* Explanatory Matter in Bilingual Dictionaries. On the whole, meaning discrimination is handled much better in classical bilingual dictionaries than in modern-language bilingual dictionaries, because the problem is much easier to analyze for a classical dictionary. The compiler of a classical dictionary must take into account the needs of the speakers of only one of the two languages, while the compiler of a modern-language bilingual dictionary usually attempts to satisfy the needs of the speakers of both languages. It is this multiplicity of purposes that has caused the confusion in bilingual lexicography for modern languages. ***James E. Iannucci.*** *Babel*, v. 5, no. 4, Dec. 1959, p. 195-199.

5743 Concise Dictionary of Science. Covers physics, mathematics, nucleonics, astronomy, and chemistry. ***Frank Gaynor.*** 546 pp. 1959. Philosophical Library, New York. (Q123 G25c Dictionary Stand)

5744 Soil and Materials Surveys by Use of Aerial Photographs. Consists of four studies, two of them being applied to specific problems. ***Highway Research Board, Bulletin*** **213, 1959, 52 pp. (TE1 H53b Contin.)**

5745 International Manual of Linguists and Translators. Lists linguists, translators, special dictionaries and grammars. Gives information on translation fees and copyrights. ***William W. Bower.*** 451 pp. 1959. The Scarecrow Press, New York. (PN886 B67i Ref.)

5746* Universal Classification—Untenable. Any attempt to construct a classification system based on existing knowledge must face at least the following two difficulties: (1) While there may be one actuality to which all knowledge refers, man as yet has no assurance that the various views he has of it are accurate. Consequently, any postulate system which could logically include all existing knowledge is built on uncertainty. (2) If a postulate system is to be devised to include future knowledge, the postulates must be arrived at by speculation unless it is assumed that no new knowledge is ever to be discovered. ***Vern M. Pings.*** *Library Resources and Technical Services*, v. 4, no. 1, Winter, 1960, p. 5-13.

5747 For the Executive With Something to Say: Writing for the Business Press. Explains basic guideposts to good writing to be followed by managers who say "I'm not a writer". ***Pilson W. Kelly.*** *Management Review*, v. 49, Feb. 1960, p. 14-22.

5748* Micro-Opaques. Discusses the microjournal and its possible role in technical literature. The publication of the *Wildlife Disease Journal* on microcards is given as an example. ***Gerald J. Sophar.*** *Special Libraries*, v. 51, no. 2, Feb. 1960, p. 59-62.

5749* Bibliography on Reproduction of Documentary Information, October 1957-December 1959. ***Loretta J. Kiersky.*** *Special Libraries*, v. 51, no. 2, Feb. 1960, p. 72-77.

5750 The Logical Syntax of Language. Specialists in the field of logic, to be consistent with the exacting demands of their discipline, must choose with care the words of ordinary language used to explain their various formulae and relationships between them. Presents a formal and exact method for

the construction of expository context which conforms to the demands of logic. ***Rudolf Carnap.*** 1959. Littlefield, Adams & Co., Paterson, N. J. (P325 G21Ltr.)

5751 The Use of Digital Computers in Speech Analysis and Synthesis. First, the voice signal is measured in a Vocoder type of analyzer and the output information digitized. The spectrum pattern data is then reduced by selecting the "best approximations" from a stored set of spectrum patterns and reading out the pattern "serial numbers". The serial numbers of the sequences are transmitted. At the receiver, an inverse process expands the information to a voice output. ***C. P. Smith.*** *U. S. Air Force, Cambridge Research Center, AFCRC-TN-59-958*, Nov. 1959, 10 pp. (TK7800 Un3.12c Contin.)

See also: **5202** (saline water conversion bibliography).

INSTRUMENTATION

5752 New Means for Brightness Measurement. Possibilities of serious errors in brightness measurements on metal surfaces is indicated. Development of a new brightness meter giving strictly reproducible results. Measuring technique with the new instrument. ***H. D. Schulz-Methke.*** *Henry Brutcher Translation No.* 4649, 10 pp. (From *Metall*, v. 12, no. 6, 1958, p. 526-528.) Henry Brutcher, Altadena, Calif.

5753* Resistance Thermometry. There is no doubt that, as the improved stability of thermistors becomes well established and accepted, they will replace the more expensive metallic resistance thermometers in many applications where an accuracy of 0·1 C over long periods is acceptable and where recalibration of replacement elements is permissible. ***K. M. Greenland.*** *Control*, v. 3, no. 20, Feb. 1960, p. 113-114.

5754* A Transfer Function Analyser. Theoretical background, technical design of the instantaneous reading system, and accuracy are discussed. ***J. G. A. v. Breugel, P. J. Rademakers, and C. M. Verhagen.*** *Instrument Practice*, v. 14, Jan. 1960, p. 43-47.

5755 Instrumentation in Scientific Research. Electrical Input Transducers. Discusses mechanical input, temperature, magnetic, electrical, and radiation transducers. ***Kurt S. Lion.*** 324 pp. 1959. McGraw-Hill, New York. (QC543 L66i)

5756 An Inexpensive Differential Thermal Analysis Apparatus. An apparatus that performs reasonably well in the temperature range from ambient to 800 C consists of an easily built furnace and stainless steel sample holder; a motor-driven variable transformer to control the temperature of the furnace; and an inexpensive strip-chart microvolt recorder made from an illuminated D'Arsonval type galvanometer. The operation of the apparatus is completely automatic. ***Wesley W. Wendlandt.*** *Journal of Chemical Education*, v. 37, Feb. 1960, p. 94-96.

5757 Apparatus for Measuring the Thermal Conductivities of Metals. An apparatus was constructed for measuring the thermal conductivities of metals and alloys in the range from 40-700 C. Measurements can be made with a precision of ±4% or better. ***S. T. Zegler and M. V. Nevitt.*** *U. S. Atomic Energy Commission, ANL-5611*, Oct. 1959, 15 pp. (UF767 Un3.1an Contin.)

See also: **5180** (high-temperature measurement).

LUBRICATION AND FRICTION

5758 A Method for Determining the Demulsibility of Lubricating Oils. ***Paul D. Metzger.*** *ASTM Bulletin*, no. 242, Dec. 1959, p. 77-79.

5759 The Laboratory Development and Evaluation of a Thixotropic Protective Oil for Critical Metal Surfaces. Tests show that the type of thixotropic protective described is a considerable advance over the conventional oil-type protectives currently available. ***E. C. Kuster.*** *Australia, Defense Standards Laboratories, D.S.L. Report* 242, July 1959, 17 pp. (T1 Au78.2r Vis.)

5760* Printing Lubrication. Lubricating of printing equipment in general, and especially letter-press equipment. *Lubrication*, v. 45, Dec. 1959, p. 157-180.

5761* The Behavior of Lubricated Ball Bearings in Controlled Atmospheres. Ball bearings were run in gaseous atmospheres free of O and H_2O vapor and the influence of this environment on bearing performance studied. The gases used in this study included H, He, and N-H mixture. In general, bearing operation was satisfactory in the gaseous environments, provided they were copiously lubricated with petroleum or turbine oils. Bearing surfaces appeared highly polished after running in pure gases. The polishing effect was most noticeable in bearings operated in H environment—the rubbing surfaces having a finish comparable to a metallographic polish. ***W. A. Glaeser.*** *Lubrication Engineering*, v. 16, Feb. 1960, p. 56-60.

5762* Determination and Correlation of Fundamental Instrument Bearing Parameters. Shows why the measurement and evaluation of dimensional, geometrical and performance qualities of miniature instrument ball bearings require the use of unique ultra-precise instruments. Describes instrumentation used to accomplish the required measurements and particularly the development of a bearing quality analyzer. Illustrates use, correlation, and interpretation of these instruments and test data. ***Theodore P. Barnard and Richard S. Guyette.*** *Lubrication Engineering*, v. 16, Feb. 1960, p. 61-68.

5763* Progress in Roller Bearing Lubrication. Results of laboratory and field service tests are presented to show the progress being made toward operation of freight car journal roller bearings over a four-year lubrication period without adding grease. ***O. J. Horger.*** *Lubrication Engineering*, v. 16, Feb. 1960, p. 69-76.

5764 Babbitt Bearings. A guide to proper selection of bearing composition, surface preparation, tinning, and babbitting to insure top performance and reliable service. ***F. E. Black.*** *Machine Design*, v. 32, Feb. 18, 1960, p. 163-165.

5765 Turbine-Bearing Design. Journal bearings for electric-utility turbines require the ultimate in bearing reliability. Current research ranges from oil-film damping to electrical pitting. Warning devices with hydraulic trips now guard the turbines. ***Paul C. Warner.*** *Mechanical Engineering*, v. 82, Feb. 1960, p. 82-85.

5766* Wear Rates in Chassis Lubrication (Passenger Cars). Although road tests have been used extensively to evaluate performance of chassis greases, little quantitative information is available on wear rates. To learn how much each chassis part wears, fifteen cars representing seven makes and lubricated with four greases were driven about 25,000 miles, and wear was determined by loss in weight of the parts. To avoid further difficult and costly road testing, a laboratory tester was developed that duplicates the action of plain oscillating bearings. ***L. C. Brunstrum and W. L. Hayne, Jr.*** *NLGI Spokesman*, v. 23, no. 10, Jan. 1960, p. 394-400.

5767 The Choice of Gear Lubricants. A representative group of gears was analyzed with respect to materials, speeds and loads; the desirable qualities of suitable lubricants are discussed. Results of tests to measure scuffing resistance and coefficient of friction in disc machines are considered using lubricants differing widely in viscosity and these are related to industrial gear practice. The effects of different sliding velocities, slide roll ratios and tooth loading on scuffing resistance and friction are discussed. Observed performances with straight mineral oils and "extreme pressure" oils are compared and the properties of a few unusual lubricants are mentioned. ***H. J. Watson.*** Paper from "Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958", The Institute of Mechanical Engineers, London. 1958, p. 126-134. (TJ184 In8p Over.)

5768 The Lubrication of Spur Gears. Theoretical analysis. ***J. R. Hughes and F. H. Waight.*** Paper from "Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958", The Institute of Mechanical Engineers, London. 1958, p. 135-143. (TJ184 In8p Over.)

5769 Influence of the Friction Conditions on the Magnitude of the Friction Coefficient in the Case of Rolling With Sliding. *J. A. Misharin.* Paper from "Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958", The Institute of Mechanical Engineers, London. 1958, p. 159-164. (TJ184 In8p Over.)

5770 The Wear of Slipping Wheels. At moderate slip, wear of rubber tires is found to increase as the square of the slip; at constant slip, wear increases with increasing stiffness, and decreases with increasing elastic hysteresis of the wheel. The results allow an estimate to be made of the dependence of wear on speed of travel under practical conditions. ***A. Schallamach and D. M. Turner.*** *Wear*, v. 3, no. 1, Jan. 1960, p. 1-25.

See also: **5902** (wear of metals).

MECHANICAL ENGINEERING

5771 Review of Design Information on Buckling of Unstiffened Thin Walled Circular Cylindrical Shells. *Bertram Klein.* *ARS Journal*, v. 30, Jan. 1960, p. 7-13.

5772 Plastic Buckling of Cylindrical Shells. A Theoretical Analysis and Comparison With Test Data. Numerical results show that for certain ratios of axial compressive stress to circumferential compressive stress, the critical values are higher than even the pure axial load case. No proper experimental values are available to check combined axial load and lateral pressure values. In the cases of cylinders under pure torsion or lateral pressure the theoretical predictions by the present theory give fair agreement with experimental results. ***S. Radhakrishnan.*** *Aircraft Engineering*, v. 31, Dec. 1959, p. 365-372.

5773* Effect of Shear on Ultimate Strength of Rectangular Beams With Tensile Reinforcement. A hypothesis is developed that the effect of shear in concrete beams simply reduces the potential moment of resistance below that which would be developed in pure flexure. This hypothesis forms the basis of a simple method of predicting the ultimate load and mode of failure from the known bending moment and shearing force diagrams for any beam. ***Geoffrey Brock.*** *American Concrete Institute, Journal*, v. 31; *ACI Proceedings*, v. 56, no. 7, Jan. 1960, p. 619-637.

5774* Stresses in Deep Beams. The deep beam theory is in contrast with the flexural theory in that it is mainly one of distributing a localized force. One unusual feature of deep concrete beams discovered in the course of the investigation is that the greatest tensile stress occurs not at the midspan but near the face of the support. Another interesting feature is that maximum stresses are a function of the magnitude of the load and not its location. ***Elihu Geer.*** *American Concrete Institute, Journal*, v. 31; *ACI Proceedings*, v. 56, no. 7, Jan. 1960, p. 651-661.

5775* Design of Prestressed Lift Slabs for Deflection Control. The "beam method" was developed as an approximate but applicable method of design. By this analysis, concrete slabs may be designed for proper behavior and strength without the use of the more complicated plate theory. ***Edward K. Rice and Felix Kulka.*** *American Concrete Institute, Journal*, v. 31; *ACI Proceedings*, v. 56, no. 8, Feb. 1960, p. 681-693.

5776* Behavior and Strength in Shear of Beams and Frames Without Web Reinforcement. Forty-nine simply supported concrete beams and 24 frame members were tested under several different types of loading. These included: two-point loads, midspan concentrated loads, uniform load, and axial load. The frame members and 18 simple supported beams were tested under uniform load. Ten of the beams under midspan concentrated loads were tested with an axial load of 20 kips. Special emphasis was placed on the effects of axial and uniform loads on shear strength and behavior of the members. Other variables were concrete strength, steel percentage, and span length. ***Roger Diaz De Cossio and Chester P. Siess.*** *American Concrete Institute, Journal*, v. 31; *ACI Proceedings*, v. 56, no. 8, Feb. 1960, p. 695-735.

5777* Distribution of Torsion and Bending Moments in Connected Beams and Slabs. Presents a method for determining torsion and bending moments in concrete beams and slabs connected monolithically. Solution of the problem is based on the elastic torsion theory where the effect of the torsional rigidity of beams and slabs is taken into account. Beams are assumed to be homogeneous with their ends rigidly fixed. ***M. A. Gouda.*** *American Concrete Institute, Journal*, v. 31; *ACI Proceedings*, v. 56, no. 8, Feb. 1960, p. 757-774.

5778* The Small Free-Piston Engine Compressor. Covers briefly the dynamic and power-generation aspects of a free-piston engine compressor intended for use in a residential air-conditioning system. The requirements of low initial cost, high efficiency, and compactness are met by the free-piston unit with its pneumatically operated fuel-injection system. It is important to note that the unit was developed for a specific application; however, this does not necessarily limit the free-piston engine compressor to residential air conditioning. ***J. H. McNinch, W. W. Vogelhuber, and R. J. McCrory.*** *American Gas Journal*, v. 187, Jan. 1960, p. 28-30.

5779 Design and Calculation of Welded Structures. A manual for designers and engineers in the field of welded construction and especially where rigidity calculations are needed. Fundamental theories are explained concerning the effects of inherent stresses. A summary concerning the weldability of materials is included. *(In German.)* Gestaltung und Berechnung von Schweisskonstruktionen. ***A. Erker, H. W. Hermsen, and A. Stoll.*** v. 9. 180 pp. + plates. 1959. Deutscher Verlag für Schweisstechnik (DVS) G.M.B.—Düsseldorf, Germany. (TS227 Er48g)

5780* A Handbook on Torsional Vibration. Evaluation and prediction of torsional vibration stresses; design and operation of various devices for limiting vibration; instrumentation. ***E. J. Nestorides, compiler.*** 664 pp. 1958. Cambridge University Press, London. (QA935 B77h Ref.)

5781* Air Suspension for Road Vehicles. A résumé of the course of development of the air springs of the double-convoluted and rolling-lobe types. The theory of the air spring design is discussed and typical methods of installation are described. The present-day air springs are limited to a maximum pressure of 100 lb/in² for the maximum static load. There are no minimum pressure requirements for a double-convolution bellows, but in order to obtain good flexing life and maximum spring response the rolling-lobe type is generally limited to a minimum pressure of 40 lb/in². ***J. H. Sainsbury.*** *Institution of Mechanical Engineers, Automobile Division, Proceedings*, 1957-58, no. 3, p. 75-84.

5782 Minimum Weight Analysis of Orthotropic Plates Under Compressive Loading. Longitudinal, transverse, and waffle-grid stiffening systems for flat plates were investigated by use of orthotropic plate theory and the assumption that the buckling modes occur simultaneously. After obtaining results for each stiffening configuration, the comparative structural efficiencies of the various types of plates were then considered in terms of common parameters. ***George Gerard.*** *Journal of the Aero/Space Sciences*, v. 27, Jan. 1960, p. 21 + 6 pages.

5783 Flexural Vibrations of a Thick-Walled Circular Cylinder According to the Exact Theory of Elasticity. The results also apply to flexural wave propagation in infinitely long cylindrical shells. Curves of phase velocity and frequency as a function of wavelength ratio and wall thickness ratio are given. Included are some comparisons between the exact theory, the Timoshenko beam theory, and shell theory. ***Joshua E. Greenspon.*** *Journal of the Aero/Space Sciences*, v. 27, Jan. 1960, p. 37-40.

5784 Large Deflections of Structures Subjected to Heating and External Loads. The method of direct formulation of the stiffness matrix is extended to include the effects of

nonuniform heating and large deflections. ***M. J. Turner, E. H. Dill, H. C. Martin, and R. J. Melosh.*** *Journal of the Aero/Space Sciences*, v. 27, Feb. 1960, p. 97 + 10 pages.

5785 Investigations Into Braking of Tractors and Trailers. Measuring instruments and methods of investigation, brake-application power, braking control, application time, force build-up time and mean deceleration, force required for uniform tire sliding, dependence of vehicle stopping distance, and other problems. ***Sigfrid Bjerninger.*** *Kungliga Tekniska Högskolans Handlingar*, no. 138, 1959, 136 pp. (T4 K96t Vis.)

5786 A Problem on Stress Waves in an Infinite Elastic Plate. An infinite, isotropic, elastic plate, subjected to a transverse impulsive load at one point of its upper surface is considered. The displacement at that point on the lower surface that is opposite to the point of impact is calculated and evaluated numerically. Comparison with experimental results is made. The Cagniard method is used. ***K. B. Broberg.*** *Kungliga Tekniska Högskolans Handlingar*, no. 139, 1959, 26 pp. (T4 K96t Vis.)

5787 On Planing Boats. The wetted surface of the boat is assumed to be flat and smooth, whence follows that the linearized surface wave theory is relevant in this case. A general class of pressure distributions is presented, and any allowed pressure distribution can be approximated by functions of this class. ***Bengt Joel Andersson.*** *Kungliga Tekniska Högskolans Handlingar*, no. 141, 1959, 29 pp. (T4 K96t Vis.)

5788 Continuous Cam Curves. Develops a system for continuous cam curves by combining cycloidal and harmonic displacements so that the acceleration forces are kept to a minimum and have no sudden changes in magnitude. By use of cycloidal and harmonic curves, displacement tables already available can be used. ***Edgar Schmidt.*** *Machine Design*, v. 32, Jan. 7, 1960, p. 127-132.

5789 Four Ways to Calculate Planetary Gear Trains. Planetary gear trains can become complicated. Motions of components and their relationships are not always apparent. Thus, analyzing planetary gear trains is not a "handbook" matter; basic understanding is required. Four methods of general approach are presented which give this fundamental insight: energy, graphical, relative-velocity and tabular methods. Of the four, the graphical method is best for quick checks. ***William H. Wilkinson.*** *Machine Design*, v. 32, Jan. 7, 1960, p. 155-159.

5790 Simplified Vibration Analysis. I. Mobility and Impedance Concepts. Techniques for finding motion and force relationships in vibrating systems. ***Austin H. Church.*** *Machine Design*, v. 32, Feb. 18, 1960, p. 130-139.

5791 Dynamic Acceleration Analysis. A method for solution of accelerations in mechanisms when only the forces acting on one or more parts are known. ***J. Hirschhorn.*** *Machine Design*, v. 32, Feb. 18, 1960, p. 151-155.

5792 Designing Tubular Coil Springs. Design data and formulas for a new type of coil spring design which uses round tubing instead of solid wire or bar. ***Charles W. Bert.*** *Machine Design*, v. 32, Feb. 18, 1960, p. 174-180.

5793 Mechanical Design and Analysis. Limit dimensioning; materials and processes; cyclic loads; stress concentrations; factors of safety; working stresses; design of machine parts and mechanisms. ***R. R. Slaymaker.*** 418 pp. 1959. John Wiley & Sons, New York. (TJ230 SL19m)

5794 Principles of Pavement Design. Fundamental principles; properties of pavement components; design tests; design of flexible and rigid pavements; pavement evaluation and strengthening. ***E. J. Yoder.*** 569 pp. 1959. John Wiley & Sons, New York. (TE250 Y73p)

5795 Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958. Papers on gear tooth forms, loading, stresses and failures; lubrication; manufacture of large and medium gears; measurements; and applications. 533 pp. 1958. The Institution of Mechanical Engineers, London. (TJ184 In8p Over.)

5796 The Excitation of Resonant Vibration by Gear Tooth Meshing Effects. Records of the error distribution on precision gears suggest that dynamic loading should be treated as a set of harmonic vibrations, rather than as a number of isolated transients. An outline of such a treatment is given. It is suggested that troublesome resonances are likely to be restricted to a limited band of harmonics only, and that vibrational modes involving shaft flexure may be excited at the high frequencies. ***D. C. Johnson.*** Paper from "Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958", The Institution of Mechanical Engineers, London. 1958, p. 18-23. (TJ184 In8p Over.)

5797 Dynamic Loads on Gear Teeth. Procedures for estimating loads on gears with helical teeth. ***W. A. Tuplin.*** Paper from "Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958", The Institution of Mechanical Engineers, London. 1958, p. 24-30. (TJ184 In8p Over.)

5798 Error-Induced Dynamic Gear Tooth Loads. Results of measurements of tooth deflection and of life tests on steel spur gears. ***G. Niemann and H. Rettig.*** Paper from "Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958", The Institute of Mechanical Engineers, London. 1958, p. 31-42. (TJ184 In8p Over.)

5799 Application of Non-Dimensional Parameters in Gear Tooth Design. ***R. Wydler.*** Paper from "Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958", The Institute of Mechanical Engineers, London. 1958, p. 62-71. (TJ184 In8p Over.)

5800 Precision Gearing for Control Systems and Armaments. Describes a system of tolerancing and dimensioning for gear trains, and for instrument and power drives which have to run with a minimum of backlash. ***R. A. Head.*** Paper from "Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958", The Institute of Mechanical Engineers, London. 1958, p. 251-263. (TJ184 In8p Over.)

5801 A review of the Application of Gear Drives to Instruments and Power Mountings. ***N. H. A. Warren.*** Paper from "Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958", The Institute of Mechanical Engineers, London. 1958, p. 327-332. (TJ184 In8p Over.)

5802 Proceedings of the Second Japan Congress on Testing Materials. 1959, 244 pp. The Japan Society for Testing Materials, Kyoto, Japan. (TA410 J27p2 Over.)

5803 How Light a Spring for Absorbing Shock? Equations for quickly finding the lightest type needed to absorb impact of a mass. Dimensions can later be varied at will, without affecting the weight requirement. ***William A. Welch.*** *Product Engineering*, v. 31, no. 5, Feb. 1, 1960, p. 49-53.

5804* The Local Buckling of Aluminium Plate Elements. Methods for calculating stresses in sections having large overall dimensions and relatively small wall thickness. ***K. Sutter.*** *Sheet Metal Industries*, v. 37, Jan. 1960, p. 23-62.

5805 The Theory of Thin Shells. Deals with the linearized theory of thin shells, based on the assumptions that straight fibers perpendicular to the middle surface remain straight and perpendicular to it after deformation, and that direct stresses perpendicular to the middle surface may be neglected. ***V. V. Novozhilov.*** 376 pp. 1959. P. Noordhoff Ltd., Groningen, The Netherlands. (QA935 N85ttr)

5806* Selecting Springs From Stock Lengths. Procedures for setting up and using proportional charts. ***Raymond D. Bohannon.*** *Tool Engineer*, v. 44, no. 1, Jan. 1960, p. 101-103.

5807 The Effects of Inelastic Action on the Resistance to Various Types of Loads of Ductile Members Made From Various Classes of Metals. XII. Eccentrically-Loaded Tension Members and Columns Made of 17-7PH Stainless Steel and Ti 155A Titanium Alloy and Tested at Various Temperatures. ***O. M. Sidebottom, S. Dharmarajan, J. L. Gubser, and J. D. Leasure.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 56-330, Oct. 1, 1959, 74 pp. (TL507 Un3.18w Vis.)

5808 Theoretical Analysis of the Creep Collapse of Columns. A creep variational principle is applied to analyze idealized H-section and solid rectangular-section columns. For the rectangular-section columns in one case the stress distribution through the thickness is assumed to be linear, and in another case the stress distribution is permitted to be nonlinear. Charts are given for the critical lifetime parameters based on these various theories. ***Floyd R. Schlechte.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-95,* Sept. 1959, 46 pp. (TL570 Un3t Vis.)

5809 Graphical Presentation of Difference Solutions for Transient Radial Heat Conduction in Hollow Cylinders With Heat Transfer at the Inner Radius and Finite Slabs With Heat Transfer at One Boundary. Nondimensional temperature distributions for transient radial heat conduction through hollow cylinders and one-dimensional heat conduction in slabs of finite thickness are presented in graphical form for a range of heat input. The solutions are for radial heat conduction with heat transfer at the inner radius or slab heat conduction with heat transfer at one boundary. ***James E. Hatch, Ralph L. Schacht, Lynn U. Albers, and Paul G. Saper.*** *U. S. National Aeronautics and Space Administration, Technical Report, NASA TR-R-56,* 1960, 58 pp. (TL521 Un3ra Vis.)

5810 Predicted Behavior of Rapidly Heated Metals in Compression. A phenomenological relation previously proposed for a metal in tension at elevated temperatures is applied to compression under rapid-heating conditions. Predictions are made of the behavior of 7075-T6 Al-alloy sheet in compression under unrestrained constant-stress conditions and under completely restrained condition for temperature rates from 0.1 to 100 F per second. ***Elbridge Z. Stowell and George J. Heimerl.*** *U. S. National Aeronautics and Space Administration, Technical Report, NASA TR-R-59,* 1960, 15 pp. (TL521 Un3ra Vis.)

See also: **6148** (design of elastomer seals).

METALLURGY

5811* Fabrication of Sintered Plate Nickel-Cadmium Batteries. The process of sintering, impregnation, forming and assembling are described. Graphs illustrating the performance of the cells assembled in the laboratory are presented. ***P. V. Vasudeva Rao, S. Ghosh, and H. V. K. Udupa.*** *Electrochemical Society, India Section, Bulletin,* v. 8, no. 4, Oct. 1959, p. 89-94.

5812 Strength of Metals. Proposed classification of ferrous and nonferrous metals and alloys, based upon low-, medium-, and high-tensile range. ***G. Fitzgerald Lee.*** *Iron & Steel,* v. 33, no. 1, Jan. 1960, p. 9-10.

5813 Permanent Magnets. Production Methods, Plant and Quality Control at Swift Levick. ***D. M. Potter.*** *Iron & Steel,* v. 33, no. 1, Jan. 1960, p. 23-27.

5814 The Properties and Applications of Commercial Arc-Cast Molybdenum and Its Alloys. Describes the consumable-electrode vacuum-arc casting process used by the Climax Molybdenum Company to produce Mo and Mo-base alloy ingots from powder. Ingots as large as 12 inches in diameter and weighing up to 2000 pounds can now be cast by this process. The availability of other forms of arc-cast Mo are discussed. The physical, chemical and mechanical properties of greatest commercial interest are examined. ***R. R. Freeman.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 203-222. (TN695 P69p)

5815 Plansee Proceedings 1958. High-Melting Metals. Papers presented at the Third Plansee Seminar "De Re Metallica" held June 22-26, 1958, Reutte/Tyrol. *(In English, French, and German.)* ***F. Benesovsky, editor.*** 465 pp. 1959. Metallwerk Plansee AG., Reutte/Tyrol, Springer-Verlag, Vienna. (TN695 P69p)

5816 The Consolidation, Fabrication and Properties of Niobium. ***L. R. Williams and T. J. Heal.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 350-370. (TN695 P69p)

5817* Platinium in the Glass Industry. In the glass industry of today Pt and its alloys are accepted as essential tools in the successful production of a wide variety of glass-ware. Reviews the most important of these applications of Pt and outlines some newer developments. ***Eric Preston.*** *Platinum Metals Review,* v. 4, no. 1, Jan. 1960, p. 2-9.

5818* The Platinum of New Granada. Continues story of Pt mining and metallurgy in the Spanish-American colonies during the eighteenth century. At one time Pt was ordered to be thrown into the river as a nuisance, but scientific reports from Europe prompted the Spanish Government to seek useful outlets for the metal. ***Donald McDonald.*** *Platinum Metals Review,* v. 4, no. 1, Jan. 1960, p. 27-31.

5819 Development of a Nickel-Base Material Dispersion-Hardened by Alumina for 1600°F to 2000°F Service. Report on literature survey on dispersion hardening, the enhancement of elevated temperature properties by ordering, and on the preparation of experimental alloys. ***D. H. Feisel.*** *Westinghouse Research Laboratories, Development of a Nickel-Base Material Dispersion-Hardened by Alumina for 1600°F to 2000°F Service, Progress Report No.* 2, May 20, 1959, 19 pp. (TN799.N6 W52d Contin.)

See also: **5019** (properties and applications of Mg alloys); **5025** (high strength aircraft steels).

METALS—CORROSION

5820 Influence of Small Quantities of Nickel on the Oxidation of Copper. Oxidation was carried out in pure O at atmospheric pressure at temperatures equal to or below 200 C. Under these conditions, there always exists a large region where only Cu_2O is formed. This study shows that: (1) the alloys of Cu-Ni containing 5 and 10% Ni oxidize less rapidly than pure Cu during the period studied; (2) alloys containing 0.5 and 1% Ni oxidize more rapidly during an initial period, the length of which varies inversely with the Ni content; (3) the alloys containing 0.1% oxidize the most rapidly during the period investigated; (4) the oxide CuO always appears sooner on these alloys. *(In French.)* Influence de faibles quantités de nickel sur l'oxydation du cuivre. ***F. Bouillon and J. Stevens.*** *Acta Metallurgica,* v. 7, Dec. 1959, p. 774-776.

5821 Copper in Domestic Water Systems (A Review). Information on the use of Cu pipe and fittings in domestic water supply systems with 50 references. The cause of corrosion of Cu pipes, the cause of green staining (cupro-solvency), and the inhibition of these difficulties are discussed. ***John Ungar.*** *Canada, Mines Branch, Information Circular, IC* 107, Sept. 1, 1959, 16 pp. (TN26 C16.5i Contin.)

5822* Influence of H_2O_2 on Al Corrosion in Alkaline Solutions, With Reference to the Formation of "Aluminum Blacks". Tests were carried out at different temperatures with varying NaOH and H_2O_2 concentrations. H_2O_2 in high concentrations displays an inhibiting action, while in lower concentrations the corrosion shows a characteristic behavior; a black film is formed. The protecting effect of this film is poor and of limited life because it cracks, and crosspoints of cracks become points of preferred attack with start of pitting corrosion. *(In Italian.)* Influenza di H_2O_2 sulla corrosione dell'alluminio nelle soluzioni alcaline in relazione alla comparsa di "neri" di alluminio. ***G. Caprioglio, P. Cipolli, and F. Mazza.*** *Chimica e l'Industria,* v. 42, Jan. 1960, p. 30-40.

5823 Sources of Underground Corrosion Potential Differences. Explains potential of metals in their environments and its role in galvanic corrosion. Sources of potentials discussed include polarization, stray current, dissimilar metals, differences in electrolyte, and differences in structure surface. ***K. G. Compton.*** *Corrosion,* v. 16, Feb. 1960, p. 87-90.

5824 Anodic Passivation Studies. Development of a potential controller which allows metal passivation to become of immediate practical importance. ***J. D. Sudbury, O. L. Riggs, Jr., and D. A. Shock.*** *Corrosion*, v. 16, Feb. 1960, p. 91-98.

5825 Application of Anodic Protection in the Chemical Industry. Presents the factors which are important to consider in evaluating a given metal-electrolyte system for the application of anodic protection. The general requirements are discussed first, and then a number of examples are given. ***D. A. Shock, O. L. Riggs, and J. D. Sudbury.*** *Corrosion*, v. 16, Feb. 1960, p. 99-102.

5826 Anodic Control of Corrosion in a Sulfonation Plant. Using the newly developed automatic potential controller, anodic protection can be used to prevent a severe corrosion problem in the manufacture of petroleum sulfonates. ***Olen L. Riggs, Jr., Merle Hutchison, and N. L. Conger.*** *Corrosion*, v. 16, Feb. 1960, p. 102-106.

5827 Corrosion Behavior of High Purity Vanadium. Chemical and galvanic corrosion experiments at 35 C show that ductile V is resistant to corrosion in substitute ocean water. It is also resistant to 60% H_2SO_4 and 20% HCl but corrodes rapidly in nitric acid solutions. ***David Schlain, Charles B. Kenahan, and Walter L. Acherman.*** *Corrosion*, v. 16, Feb. 1960, p. 114-116.

5828 High-Temperature, High-Pressure Oxidation of Alloys Caused by Carbon Dioxide. Describes oxidation behavior of 26 heat-resistant alloys in 1000 to 2000 psi CO_2 in the temperature range of 1100 to 1740 F. Oxidation rates in 2000-psi CO_2 at 1300 and 1500 F were very low. In all cases, scales were protective. ***J. C. Bokros and W. P. Wallace.*** *Corrosion*, v. 16, Feb. 1960, p. 117-122.

5829 Effects of Velocity on Corrosion. Explains relation between corrosion rate factors and velocity on corrosion of Fe and other metals. Also discusses galvanic effects produced by changes in velocity. Includes discussion of erosion corrosion of Fe, Cu alloy, and other alloys plus explanation of cavitation corrosion. ***H. R. Copson.*** *Corrosion*, v. 16, Feb. 1960, p. 130-136.

5830 Corrosion Testing of Two Zirconium Alloys. Some of the external factors influencing the high-temperature water and steam corrosion properties. ***Stanley Kass.*** *Corrosion*, v. 16, Feb. 1960, p. 137-143.

5831 Advances in Cathodic Protection of Tankers. Cathodic protection within ballasted cargo compartments in tankers has now been employed for almost a decade. One particular advance, taking advantage of the constructional members of the ship, is described here. This system has recently been patented. ***D. Spector.*** *Corrosion Technology*, v. 7, Jan. 1960, p. 5-8.

5832 Basic Research in America N.B.S. Progress in Corrosion Studies. Large single metal crystals are employed in some of the research to correlate corrosion with the arrangement of atoms in the crystal lattice. Other studies include the electrical phenomena, the mechanism of the formation of oxide films, and the effect of illumination on the corrosion reaction. *Corrosion Technology*, v. 7, Jan. 1960, p. 12-14.

5833 Corrosion Symposium Problems of the Petroleum Industry. Abstracts of papers presented Nov. 26-27, 1959, at a joint symposium held by the Institute of Petroleum and the Society of Chemical Industry in London. The subject of the symposium was "Corrosion Problems of the Petroleum Industry". *Corrosion Technology*, v. 7, Jan. 1960, p. 16-20.

5834 The Tanker Anode Safety Considerations in Design. The recent inquiry into the loss of the Stanvac Japan and the suggestion that the explosion may have been connected with the presence within the compartments of Mg anodes once again emphasizes the related importance of anode, mounting, and system design. This article considers these three points. *Corrosion Technology*, v. 7, Jan. 1960, p. 21-22.

5835 Corrosion Mechanisms in the Reaction of Steel With Water and Oxygenated Solutions at Room Temperature and 316°C. Data on the transformation behavior of the corrosion products involved and a summary of some of their physical properties. ***Mary Boehm Strauss and M. C. Bloom.*** *Electrochemical Society, Journal*, v. 107, Feb. 1960, p. 73-79.

5836 Corrosion of Nickel Coated Mild Steel. Results are discussed with reference to the precipitation of basic iron salts, the electrochemical anisotropy of different faces of a single crystal, and the texture of the deposits. ***B. C. Banerjee.*** *Electrochemical Society, Journal*, v. 107, Feb. 1960, p. 80-82.

5837 The Kinetics of the Corrosion of Low-Hafnium Zirconium in Aqueous Sulfuric Acid Solutions. The samples first were etched in an aqueous HF-HND_3 solution, then placed directly into the H_2SO_4 solution. The initial corrosion followed a parabolic rate law which was followed by a constant rate. Corrosion during the constant reaction rate period was faster, by an order of magnitude or more, than rates reported in the literature for unetched samples under similar conditions. This is thought to be due to the removal of the protective oxide film on etching and the subsequent growth of some less-protective film in the H_2SO_4 solution. ***Tennyson Smith.*** *Electrochemical Society, Journal*, v. 107, Feb. 1960, p. 82-86.

5838 The Corrosion of Aluminium and Its Alloys in High-Pressure Steam. Three distinct types of corrosion have been observed: (1) uniform film growth, (2) penetrating attack, starting from points and spreading over the whole surface, the final product being a fine grey powder, and (3) "growth" of the specimen. ***N. J. M. Wilkins and J. N. Wanklyn.*** *Institute of Metals, Journal*, v. 88, pt. 3, Nov. 1959, p. 134-140.

5839 The Compatibility of Molybdenum, Tantalum, and Niobium With Liquid Bismuth and Bismuth-Uranium Solutions. Tantalum and Mo show good resistance to static Bi-U solutions at temperatures up to 800 C. A dynamic test showed that Mo also exhibited good resistance to thermal gradient mass transfer in liquid Bi under static conditions at 1000 C but under these conditions its resistance was poor. ***E. D. Lloyd.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 249-256. (TN695 P69p)

5840* Anodic Corrosion Control. A New Method of Protection by Passivation. *Platinum Metals Review*, v. 4, no. 1, Jan. 1960, p. 17.

5841 High Temperature Aqueous Corrosion of Aluminum-Plutonium and Aluminum-Silicon-Plutonium Alloys. Aluminum-plutonium and Al-Si-Pu alloys were tested to determine their short-term corrosion performance in 350 and 360 C water. Tests of one day or less duration were done on bare as-cast and bare extruded alloys of varying Pu concentration. The performance of these alloys improves with increasing Pu content up to at least 13%. ***H. C. Bowen.*** *U. S. Atomic Energy Commission, HW*-61345, July 31, 1959, 11 pp. (UF767 Un3.1hw Contin.)

See also: **6036** (mild and stainless 316 L steel corrosion in U ore leaching).

METALS—EXTRACTION AND REFINING

5842 Effect of Gases on Hardness of Rimmed and Killed Low-Carbon Steel. Increase of the N content within the permissible limits substantially increases the hardness of low-C Al-deoxidized steel. The least possible amount of N should be allowed to enter these steels during their production. ***B. S. Natapov and E. S. Fal'kevich.*** *Henry Brutcher Translation No.* 4622, 7 pp. (From *IZV. VUZ, Chern. Met.*, no. 11, Nov. 1958, p. 95-98.) Henry Brutcher, Altadena, Calif.

5843 Dry Lurgi-Type Electrical Dust Precipitator for the LD Process. Description of an industrial-scale Lurgi-type precipitator developed to cope with special problems posed by extremely fine dust particles in brown fumes. ***F. Kolbe.*** *Henry Brutcher Translation No.* 4718, 14 pp. (From *Bergund Hüttenmännische Monatshefte*, v. 104, no. 2, 1959, p. 26-31.) Henry Brutcher, Altadena, Calif.

5844 Flames and Furnaces. An extract from Chapter 4 of the author's forthcoming book, "The Science of Flames and Furnaces" (second edition); considers thermodynamic radiation studies; discusses and tabulates emissivity or absorptivity of various materials. ***M. W. Thring.*** *Iron & Steel,* v. 33, no. 1, Jan. 1960, p. 11-15.

5845 Pig Iron From Scrap Steel. Ferranti Ltd. will produce their foundry pig iron from scrap steel, installing for this purpose a new 3-ton electric-arc furnace; considerable economy is anticipated. *Iron & Steel,* v. 33, no. 1, Jan. 1960, p. 33-34.

5846 Some New Techniques for Preparing Small Quantities of High Purity Refractory Metals. New techniques for removing trace impurities, and, in particular, interstitial elements from high melting point metals such as Ta and Mo. Apparatus is described for solid state purification both by resistance heating and electron bombardment and apparatus for liquid state purification by zone refining is also described. The relative merits of solid state and liquid state purification are discussed. ***D. A. Robins and I. Jenkins.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 324-335. (TN695 P69p)

5847 The Development of Large Scale Electron Bombardment Melting and Its Effect on the Composition of Metals and Alloys. ***H. R. Smith, Jr., Ch. d'A. Hunt, and Ch. W. Hanks.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 336-349. (TN695 P69p)

5848 High-Purity Tungsten by Fluoride Reduction. The Bureau of Mines has made W metal in massive form on a laboratory scale by H reduction of tungsten hexafluoride (WF_6). Metal made in this manner had a purity of 99.99% or better, with reference to all detectable impurities, including gases. Tungsten was deposited in the form of columnar crystals having a specific gravity of 19.25, as determined by water displacement. ***V. A. Nieberlein and H. Kenworthy.*** *U. S. Bureau of Mines Report of Investigations* 5539, 1959, 12 pp. (TN21 Un3r Vis.)

See also: **6037** (iron in a fluidized bed).

METALS—FINISHING, POLISHING, AND CLEANING

5849 How to Work With Stainless to Get Sanitary Finishes. Increasing demand for containers for handling dairy and food products puts a premium on production of sanitary finishes. Gives a few hints on processing aids in grinding and polishing stainless tanks. ***R. H. Water and W. A. Corse.*** *Iron Age,* v. 185, no. 8, Feb. 25, 1960, p. 76-78.

5850* Cleaning Missile Tanks by Vapor Degreasing. Developed for cleaning the interior of liquid oxygen tanks for missiles, closed-system vapor degreasing is now catching on in the trucking industry. The new method does the job of removing asphalt, mineral, vegetable and animal oils, fats, most resins and plasticizers from tank walls much more quickly and economically than the old batch method. *Metal Progress,* v. 77, no. 2, Feb. 1960, p. 88-90.

5851 Paint Stripping Technology Today. Types of stripping compounds; what now-available materials will do; what to expect from strippers now in the development stage. ***L. J. Durney.*** *Products Finishing,* v. 24, no. 6, Mar. 1960, p. 39 + 4 pages.

5852 What Precision Barrel Finishing Can Do. Gives examples of precision jobs now being performed. ***J. J. Forrester, Jr.*** *Products Finishing,* v. 24, no. 6, Mar. 1960, p. 54-56.

METALS—FOUNDRY PRACTICE

5853* The Properties of Castings in Shell Moulds. Shell-molded castings in Al bronze and Al alloy LM4 were found to have similar properties and structure to those made in ordinary green-sand molds. The incidence of metal-mold reaction in shell molds is shown to be less severe than in ordinary sand molds. ***W. W. Glick.*** *British Foundryman,* v. 53, Jan. 1960, p. 1-10.

5854* The Effect of Vibration on Stress Relief of Castings. Third Report of Sub-Committee TS 32 of the Technical Council. No useful relief of stress was achieved by any of the treatments applied under any conditions, though there was an indication of a very small relief of stress by vibration at high levels of internal stress. *British Foundryman,* v. 53, Jan. 1960, p. 10-13.

5855* Flow of Metal Into Moulds. Report of Sub-Committee TS35 of the Technical Council. A series of photographs from the film of this title. *British Foundryman,* v. 53, Jan. 1960, p. 15-20.

5856* Pressure-Diecasting Problems in a Jobbing Foundry. An attempt to pinpoint the major problems confronting the jobbing pressure-diecasting foundry. ***H. R. Abram.*** *British Foundryman,* v. 53, Jan. 1960, p. 20-23.

5857* Steelfoundry Production Developments. ***D. Bennett.*** *British Foundryman,* v. 53, Jan. 1960, p. 31-36.

5858* Mould Drying. Second Report of Sub-Committee TS 39 of the Technical Council. A review of the factors involved in the drying and skin drying of molds, with special reference to the rate of removal of moisture from the mold surface. *British Foundryman,* v. 53, Jan. 1960, p. 41-48.

5859 Vacuum Melting and Casting. The recent publications in this country relating to vacuum melting and casting are reviewed, mainly from the metallurgical viewpoint. Developments in vacuum technique are described, and, on the production side, vacuum treatment during melting and casting are separately considered. A brief résumé is included of the different forms of oxidation which can take place during conventional castings. The economics of the subject, where available, are described. ***K. G. Lewis.*** *Iron & Steel,* v. 33, no. 1, Jan. 1960, p. 3-8.

5860* The Metallurgy and Production of Aluminum and Zinc Castings. Transcript of a tape-recorded question-and-answer session before the Bridgeport, Conn., AES Branch. ***Donald L. La Velle.*** *Plating,* v. 47, Feb. 1960, p. 180-187.

See also: **5237** (determination of S in cast iron); **5886** (properties of grey iron castings).

METALS—HEAT TREATMENT

5861 Spark-Hardening of Metals. The influence of electric sparks on the structure and hardness of metal surfaces was studied, a vibrating electrode being used to generate the sparks. Steel surfaces are hardened by the thermal cycling, but evidence is given that elements derived from the sparking medium accentuate the hardness change. Surface alloying also occurs by the transfer of matter between the sparking contacts, and experiments with sintered-carbide electrodes show that very hard, wear-resistant layers can be formed on most engineering metals. Spark treatment has been successfully developed in Russia as a practical process for hard-surfacing steel, and wear tests carried out in the present work indicate its potential value in non-ferrous metals. ***N. C. Welsh.*** *Institute of Metals, Journal,* v. 88, pt. 3, Nov. 1959, p. 103-111.

5862 The Influence of Prior Heat-Treatment on Recrystallization of Commercial Aluminium. A study has been made of the influence of variation in intermediate annealing temperature. Intermediate soaking at 500 C, as compared with soaking at lower temperatures, retards softening and recrystallization during the final anneal and favors the formation of coarse, imperfect grains. These effects are attributed to the presence of greater amounts of impurities in solution, the higher the intermediate annealing temperature. ***T. Ll. Richards and S. F. Pugh.*** *Institute of Metals, Journal,* v. 88, pt. 3, Nov. 1959, p. 141-143.

5863* A Nitriding Steel That Age Hardens. This steel contains 5% Ni and 2% Al. It can be nitrided and hardened at the same time by an aging treatment in a nitriding atmosphere. The steel is expected to be useful for cams, gears, and shafts that need fatigue and wear resistance at elevated temperatures. ***W. S. Mounce and A. J. Miller.*** *Metal Progress*, v. 77, no. 2, Feb. 1960, p. 91-94.

5864* Sizing Jig in Quench Cycle. A description of the operation of the sizing tool. ***E. C. Buckingham.*** *Metal Progress*, v. 77, no. 2, Feb. 1960, p. 129-131.

5865 Developments in the Heat Treatment of Large (Marine) Gears. *A. Chamberlain.* Paper from "Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958", The Institute of Mechanical Engineers, London. 1958, p. 188-198. (TJ184 In8p Over.)

See also: **5881** (annealing of white-heart malleable iron).

METALS—MECHANICAL AND PHYSICAL PROPERTIES

5866 Effect of Hydrogen on the Yielding of Mild Steel. From measurements of Luder's band-front velocities it is concluded that H does not affect the activation energy for separating a dislocation and its atmosphere and thereby the delay-time for yielding. Suppression of the upper yield point by H seems rather to be caused by local stresses surrounding inclusions of molecular H, which contribute to the stresses at the specimen shoulder, and thus facilitate the initation of the first Luder's band. ***F. de Kazinczy.*** *Acta Metallurgica*, v. 7, Nov. 1959, p. 706-708.

5867 "Superhigh Plasticity" of Commercial Iron Under Cyclic Fluctuations of Temperature. While investigating by high temperature metallography the influence of cyclic fluctuations of temperature on the character of the process of deformation of Armco Fe containing 0.03% C, it was found that two necks form on the specimen in the zones with a temperature of about 720-850 C when a temperature gradient arises along the specimen and with definite durations of exposure with limiting temperatures. The appearance of two necks shows that the development of "superhigh plasticity" takes place under the temperature conditions mentioned. This phenomenon is explained by the irregular distribution of C inside the grains and its concentration near the boundaries of grains and blocks. ***Michael G. Lozinsky and Izina S. Simeonova.*** *Acta Metallurgica*, v. 7, Nov. 1959, p. 709-715.

5868 The Effect of Quenched-In Vacancies on the Elastic Modulus of Aluminum. Equipment for the dynamic measurement of modulus changes was developed. The presence of lattice vacancies was found to reduce the elastic modulus. Time relation of vacancy concentration observed was analogous to that determined by electrical resistivity measurements. ***R. C. Folweiler and F. R. Brotzen.*** *Acta Metallurgica*, v. 7, Nov. 1959, p. 716-721.

5869 Cyclic Stressing Frequency Effect on Fatigue Strength. A Study of Frequency Effect With Particular Reference to the Fatigue Strength of Certain Aluminium Alloys. The so-called frequency effect on fatigue strength, as normally measured by fatigue tests in air, usually contains an appreciable corrosion fatigue factor together with the true frequency effect. A study of the kinetics of corrosion fatigue led to a method whereby the true frequency effect can be separated from the net effect of corrosion. ***W. J. Harris.*** *Aircraft Engineering*, v. 31, Dec. 1959, p. 352-357.

5870* Some Effects of Alloying on the Strength Properties of Columbium at Elevated Temperatures. Effects of solid-solution alloying with Ti, Mo, and W at concentrations up to 10 per cent on the strength of pure Cb at elevated temperatures (mainly 2000 F) were investigated by means of creep-rupture, hot-tensile, and hot-hardness testing and recrystallization studies. ***Gordon D. Gemmell.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 898-901.

5871* Hot Indentation Testing of Magnesium and Other Selected Materials. The Larson-Miller parameter was used to correlate time, temperature, and indentation creep of Mg, Al, and some of their alloys. In the temperature range 300 to 450 C, the short-time Meyer hardness of pure Mg was less than that of the Mg alloys tested, but for long times the pure Mg has greater indentation creep resistance. Aluminum (1100 alloy) had 1.5 to 2.5 times more indentation creep resistance than Mg at 300 and 450 C, respectively. Hardening of Al with a dispersion of Al_2O_3 was effective in the time and temperature ranges studied. ***J. W. Goffard and R. G. Wheeler.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 902-904.

5872* The Fatigue Hardening of Copper. The hardening of annealed Cu during fatigue testing appears to be independent of the applied stress and to occur largely within the first 4000 cycles. Copper hardened by fatigue is more resistant to annealing than Cu hardened by static means, and softens by a multistage process. Creep studies at 300 C show that Cu hardened by fatigue also has greater resistance to creep than statically hardened Cu. Some theoretical explanations are discussed. ***Alfred Siede and A. G. Metcalfe.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 947-949.

5873* Variation in Orientation Texture of Ultra-Thin Molybdenum Permalloy Tape. Quantitative pole density stereograms of $\{111\}$ poles of ¾-mil Mo permalloy tapes from six production heats in both cold-rolled and annealed conditions were developed in order to reveal possible variations in texture and magnetic properties. The intensity of each individual texture component depends on the combined effect of many processing variables. Among other possible combinations of texture components, a relatively strong (110) [001] annealed texture component seems to associate with the highest squareness ratio and lowest coercive force of the tapes studied. ***P. K. Koh, H. A. Lewis, and H. F. Graff.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 962-967.

5874* Preferred Orientation in Warm-Worked and Heat-Treated 4340 Steel. A variation of yield and tensile strength with direction has been noted in heat-treated 4340 steel which had been warm-worked by rolling in the austenitic condition prior to quenching. Measurements by X-rays showed a preferred orientation of martensite crystals. Various ideal preferred orientations of martensite were calculated by assuming a preferred orientation for austenite and transforming this to martensite by the Kurdjumov-Sachs and Nishiyama relationships. Comparison with the measured preferred orientation showed that the ideal rolling texture for austenite in 4340 steel could be expressed as a (112) $[11\bar{1}]$ texture with a component of (110) $[\bar{1}12]$. ***Eric B. Kula and Stanley L. Lopata.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 980-985.

5875* Influence of Constraints During Rolling on the Textures of 3 Pct Silicon-Iron Crystals Initially (001) [100]. Crystals with an (001) [100] initial orientation of an Fe-base alloy containing 3 per cent Si were cold rolled with and without the use of constraints. A major difference in the rolling and annealing textures was observed between crystals rolled with and without constraints. These data show that the contribution of constraints at grain boundaries in a polycrystalline sheet should be considered in applying textural data on single crystals to grains in aggregate. ***R. G. Aspden.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 986-991.

5876* On the Origin of Tertiary Creep in an Aluminum Alloy. The mode of high-temperature tertiary creep of 52S-O Al alloy was found to be strongly stress dependent. The occurrence of necking and/or fissures during tertiary creep exhibited a sequence with varying stress, wherein fissures with no necking occur at a minimum stress and necking with no fissures occur at a maximum stress. At an intermediate stress, tertiary creep begins without necking but with fissures in a region just

beneath the external surface, followed by necking and the development of fissures along the axis of the specimen. The results are interpreted in terms of grain boundary gliding and the hydrostatic stresses produced by restraints to grain boundary gliding. ***A. S. Nemy and F. N. Rhines.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 6, Dec. 1959, p. 992-998.

5877* The Effect of Striation-Type Substructure on the Deformation of Aluminum Single Crystals. Tensile tests on Al single crystals, grown from the melt, revealed that the yield stress of these crystals was raised as the amount of striation substructure was increased. The number of striation-type boundaries was varied by changing the rate of growth of the crystals. The results are interpreted in terms of a blockage of dislocation movement by striation boundaries. ***J. T. McGrath and G. B. Craig.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 6, Dec. 1959, p. 1022-1025.

5878* Discontinuous Crack Growth in Hydrogenated Steel. The kinetics of crack propagation in a hydrogenated high-strength steel at subzero temperatures indicated that cracking progressed in a discontinuous fashion. The delayed failure process thus involves a series of crack initiations rather than the continuous growth of a single crack. The incubation time required for the initiation of delayed failure was controlled by the diffusion of H. The activation energy for the process was 9120 cal/g-atom. As the test temperature was lowered, the incubation time constituted a greater percentage of the total time to fracture and at −50 F, the incubation and fracture times were essentially coincident resulting in instantaneous, catastrophic fracture. ***E. A. Steigerwald, F. W. Schaller, and A. R. Troiano.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 6, Dec. 1959, p. 1048-1052.

5879* Short-Time Creep-Rupture Behavior of Tungsten at 2250 to 2800 C. The creep-rupture behavior of commercial powder-metallurgy tungsten rod is reported for temperatures of 2250, 2500, 2700, and 2800 C, stresses up to 7000 psi, and times up to 4 hr. The temperature dependence and the stress dependence of creep rates are evaluated. ***Walter V. Green.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 6, Dec. 1959, p. 1057-1060.

5880* Short-Time Creep-Rupture Behavior of Molybdenum at High Temperatures. The creep-rupture behavior of commercial powder-metallurgy Mo rod is reported in the temperature range 1600 to 2500 C, at stresses up to 9000 psi and times up to one month. The effects of temperature, stress, and grain growth are discussed. ***W. V. Green, M. C. Smith, and D. M. Olson.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Soceity,* v. 215, no. 6, Dec. 1959, p. 1061-1066.

5881* Dimensional Changes Occurring in Whiteheart Malleable Iron Castings During Annealing. Shows that dimensional changes are associated with different amounts of decarburization occurring during the anneal. Study of the normal day-to-day variation in metal composition indicates that such variation is partly responsible for these changes. For example, an increase in Si content, which will accelerate graphitization, retards decarburization during annealing, and castings of relatively high Si content generally finish larger than similar castings of lower Si content. ***C. T. Moore.*** *B.C.I.R.A. Journal of Research and Development,* v. 7, no. 15, Dec. 1959, p. 853-862 + 4 plates.

5882* A Note on Yield Point or Yield Stress in Malleable Cast Iron. Malleable cast irons have no true yield point, and it is misleading to apply the terms "yield point" and "yield stress" to them. It is shown that it is appropriate to quote either proof or set stress values to define the change from elastic to plastic deformation occurring in the tensile test. ***C. T. Moore.*** *B.C.I.R.A. Journal of Research and Development,* v. 7, no. 15, Dec. 1959, p. 863-866.

5883 Electrical Properties of High-Purity Silicon Made From Silicon Tetraiodide. Resistivities, type of conduction, and lifetimes of minority carriers of single crystals of iodide silicon are recorded as a function of the purification procedure. ***L. V. McCarty.*** *Electrochemical Society, Journal,* v. 106, Dec. 1959, p. 1036-1042.

5884* Research and Failures of Metals in Service. Describes some examples of mechanical breakdown and programs of research which have resulted more or less directly from them. ***C. E. Phillips and A. C. Low.*** *Institute of Marine Engineers, Transactions,* v. 71, Dec. 1959, p. 357-365.

5885 The Lorenz Constant for Steel. A discussion of recent Russian work on the effect of temperature, composition, and structure upon the Lorenz constant for steels and alloys; numerous graphs. ***P. G. Morgan.*** *Iron & Steel,* v. 33, no. 1, Jan. 1960, p. 28-30.

5886 How Section Size Affects Gray Iron Castings. Graphs compare strength, hardness and microstructure. To get desirable combinations of machinability and strength, consider microstructure and strength requirements simultaneously. ***R. C. Bates.*** *Materials in Design Engineering,* v. 51, Feb. 1960, p. 100-102.

5887 Some Physical Properties of Neptunium Metal. III. The Electrical Resistivity and Thermoelectric Power of Neptunium Metal in the Range 300-900°K. *J. A. Lee, J. P. Evans, R. O. A. Hall, and E. King.* *Physics and Chemistry of Solids,* v. 11, nos. 3-4, Oct. 1959, p. 278-283 + 1 plate.

5888 A Note on Certain Properties of Osmium and of Its Alloys With Molybdenum. The melting point of Os was determined as 3000 C by an optical pyrometer method. Arc-melted Os was found to have a hardness of 300-670 V.H.N. depending on orientation. It work-hardens at a fairly normal rate, but in an uneven manner due to its anisotropy. Molybdenum forms phases of the B-W and σ structures with Os. In solid solution in Mo, Os gives enhanced ductility, but the effect is less pronounced than that produced by Re. ***J. D. Baird, G. A. Geach, and A. G. Knapton.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 371-379. (TN695 P69p)

5889 The Effect of Rhenium on the Fabricability and Ductility of Molybdenum and Tungsten. The addition of 50% Rh (35 at %) to Mo results in the development of remarkable hot plasticity and low-temperature ductility. In arc-cast unalloyed Mo, very small amounts of oxide produce a phase with low dihedral angle, which requires deoxidation. In contrast, the Mo-Rh alloy will tolerate at least 500 ppm O in the as-cast condition and still be capable of direct hot working. The oxide redistribution mechanism found for Mo-Rh appears to apply to W-Rh. Although the low-temperature twinning mechanism is operative, low-temperature ductility is not attained, perhaps because of inability of the matrix to provide the necessary accommodation slip. As a result, about 30% Rh greatly aids the hot workability of W but is of less benefit in ductility at low temperature. ***R. I. Jaffee, C. T. Sims, and J. J. Harwood.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 380-411. (TN695 P69p)

5890* Properties of Ruthenium, Osmium and Iridium. Melting Point and Hardness Determinations. *Platinum Metals Review,* v. 4, no. 1, Jan. 1960, p. 31.

5891 Study of the Surface Fatigue Behaviour of Gear Materials With Specimens of Simple Form. Over a wide range of hardness, surface fatigue will ultimately occur when the maximum Hertzian surface pressure is approximately equal (numerically) to the tensile strength of the surface layer concerned. This relationship does not appear to be affected by structural differences or by yield/ultimate ratio or toughness rating. ***W. T. Chesters.*** Paper from "Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958", The Institute of Mechanical Engineers, London. 1958, p. 91-98. (TJ184 In8p Over.)

5892 On the New Damage Line in the Fatigue of Materials. For the design of machine parts on the basis of the fatigue life, the conventional damage line based on endurance limit seems to be undesirable. A new damage line is proposed, based on a criterion of 10% overstress. ***Minoru Kawamoto and Takao Nakagawa.*** Paper from "Proceedings of the Second Japan Congress on Testing Materials", The Japan Society for

Testing Materials, Kyoto, Japan. 1959, p. 1-4. (TA410 J27p2 Over.)

5893 Electron Microscopic Study of the Fatigue Fracture of Steel. Fatigue tests were made on 0.26% C steel specimens. No hair cracks were noticed until the number of stress cycles reached about 95% of the fatigue life. A crack consists of two parts: the waving pattern due to the plastic deformation, and the portion of rugged surface structure. The crack seems to start at a point about 0.1 to 0.5 mm from the side of the specimen. The microcrack is discontinuous and consists of many finer hair cracks. ***Minoru Kawamoto, Saburo Magari, and Takao Nakagawa.*** Paper from "Proceedings of the Second Japan Congress on Testing Materials", The Japan Society for Testing Materials, Kyoto, Japan. 1959, p. 5-9. (TA410 J27p2 Over.)

5894 The Influence of Metallurgical Factors on Fatigue Limit and the Statistical Nature of Fatigue Fracture of Plain Carbon Steel. Ferrite grain size and inclusion rating were measured for various kinds of plain C steels. Ferrite grain size is a prevalent metallurgical factor in the fatigue limit and the statistical nature of fatigue fracture of plain C steel. ***Takeo Yokobori.*** Paper from "Proceedings of the Second Japan Congress on Testing Materials", The Japan Society for Testing Materials, Kyoto, Japan. 1959, p. 10-13. (TA410 J27p2 Over.)

5895 Fatigue Strength of Notched Steel Specimens Subjected to a Reversed Torsion. Relations between fatigue limit and crack strength. ***Tadasi Isibasi and Tomokazu Matake.*** Paper from "Proceedings of the Second Japan Congress on Testing Materials", The Japan Soicety for Testing Materials, Kyoto, Japan. 1959, p. 19-21. (TA410 J27p2 Over.)

5896 On the Fatigue Strengths of Notched Specimens of Industrial, Pure Titanium and Some Titanium Alloys. The fatigue limits of unnotched specimens are 49 to 63% of their tensile strengths. The sharper the shape of the notch, the lower the fatigue limit becomes. The fatigue limit of a notched specimen was high in proportion to the value of the fatigue limit of an unnotched specimen of the same material. The fatigue limits of unnotched and notched specimens decrease with the increase of frequency of cyclic loading. ***Seikiti Hukai and Katsuzi Takeuchi.*** Paper from "Proceedings of the Second Japan Congress on Testing Materials", The Japan Society for Testing Materials, Kyoto, Japan. 1959, p. 22-25. (TA410 J27p2 Over.)

5897 On the Changes of Residual Stresses Resulting From Carburizing and Quenching Due to Aging and Repeated Stressing. Residual stresses resulting from carburizing and quenching are of the thermal stress type, being compressive at the surface and tensile in the core, and the stress reversal occurs near the boundary between case and core. Surface residual stresses tend to decrease during an aging period of seven days after quenching, to increase noticeably for the following fifteen days, and then to diminish again gradually. The effect of accelerating aging is greater by the larger stress amplitudes, and the effect of fading after the aging is completed is also increased by the higher stress amplitudes. ***Shuji Taira and Yasunori Murakami.*** Paper from "Proceedings of the Second Japan Congress on Testing Materials", The Japan Society for Testing Materials, Kyoto, Japan. 1959, p. 26-29. (TA410 J27p2 Over.)

5898 Effect of Stress-Aging on the Static and Fatigue Strength of Carbon Steel. The static strength, especially the elastic strength, of steels can be markedly improved by stress-aging, i.e., a treatment in which both mechanical stress and heat are applied simultaneously so as to accelerate the aging of the alloy. The dynamic yield point can also be increased; improvement of the fatigue strength can not be expected. The reason for this is satisfactorily explained on the basis of the theory of dislocations. ***Tadakazu Sakurai, Tadashi Kawasaki, and Hissashi Izumi.*** Paper from "Proceedings of the Second Japan Congress on Testing Materials", The Japan Society for Testing Materials, Kyoto, Japan. 1959, p. 30-33. (TA410 J27p2 Over.)

5899 The Effects of Repeated Stresses and Number of Cycles on the Longitudinal Residual Stress of Drawn Wires. ***Hiroshi Nakamura, Mutsuo Kakuzen, and Toshio Nishihara.*** Paper from "Proceedings of the Second Japan Congress on Testing Materials", The Japan Society for Testing Materials, Kyoto, Japan. 1959, p. 34-37. (TA410 J27p2 Over.)

5900* Fatigue Tests on Notched Specimens With Filled Notches. Notch effect; possibilities of reducing the notch effect; stress distribution; repeated bend tests. *(In German.)* Dauerschwingversuche an gekerbten Proben mit Füllschweissungen. ***H. Wolf.*** *Schweissen und Schneiden*, v. 12, Jan. 1960, p. 10-14.

5901 Compressive and Tensile Creep of 7075-T6 and 2024-T3 Aluminum-Alloy Sheet. Results are presented of tests at 300, 375, 450, and 600 F. Compressive and tensile creep are compared and found to be essentially the same for both materials in the primary and secondary creep regions except for 2024-T3 Al-alloy sheet at 300 and 375 F where the compressive creep was less. At 300 F where aging and prestraining effects were particularly evident, compressive creep was markedly less than tensile creep. ***George J. Heimerl and John Farquhar.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-160, Dec. 1959, 40 pp. (TL570 Un3t Vis.)

5902 Wear, Fatigue and Fretting Surface Damage of Materials. Seven papers on compatability of metal pairs, subsurface fatigue, pitting of gear teeth, scoring phenomena, fretting and fretting corrosion, and corrosion and sliding characteristics of metals at high temperatures. Sections individually paged. American Society for Metals, Cleveland. (TA460 Am35.4w Over.)

5903* Comparison of Charpy V-Notch and Drop-Weight Tests for Structural Steels. Relationship between nil-ductility transition and various Charpy V-notch transition temperatures, including the 15-mil lateral-expansion transition temperature, is examined. ***J. H. Gross.*** *Welding Journal*, v. 39, Feb. 1960, p. 59S-67S.

5904* The Cruciform Test for Plate-Cracking Susceptibility. Object is to determine the effect of selected test conditions on the ability of the cruciform test to differentiate between a good and a bad heat of armor. ***Laurence E. Poteat and William L. Warner.*** *Welding Journal*, v. 39, Feb. 1960, p. 70S-76S.

See also: **5127** (thermal conductivity measurement).

METALS—MECHANICAL WORKING

5905* Controls for Automated Pressworking. Describes examples of control arrangements for coordinating and monitoring presses and associated handling equipment. ***Lee D. Miller.*** *Automation*, v. 7, Feb. 1960, p. 74-79.

5906* Machining of Cobalt-Containing Alloys. Cobalt is an important ingredient in certain high-speed and hot-working tool steels known as redhard tool steels. It is also an important component of those materials known as "super alloys", which are used for high-temperature applications, particularly in certain aircraft components. Although commonly so regarded, these alloys are not necessarily difficult to machine if appropriate techniques are used. In general, high-quality machine tools, sharp cutting tools of appropriate designs and materials, low speeds and feeds, a continuous cutting action, and intimate cooling by appropriate cutting fluids are required for successful machining of these materials. ***C. T. Olofson and F. R. Morral.*** *Cobalt*, no. 5, Dec. 1959, p. 15-25.

5907* The Cutting Mechanism of Fine-Grain Abrasive Stone. The contact mechanism between the stone and the work surface was investigated theoretically in order to determine the number of cutting points. The number of cutting points is obtained as a function of the roughness of the stone surface, pressure on the stone and hardness of the work material. ***Tokio Sasaki and Kenjiro Okamura.*** *Kyoto University, Memoirs of the Faculty of Engineering*, v. 21, pt. 4, Oct. 1959, p. 367-392.

5908 Finishing Small Holes With Carbide "Grinding" Tools. These tools are of diamond cut pattern, "standard cut" being recommended for normal work, and "fine cut" where

high finish is more important than rapid metal removal. Successful operation of tools of both types depends on rigidity and true running of the grinding spindles. ***Fred M. Shaw.*** *Machinery (London)*, v. 95, Dec. 9, 1959, p. 1227-1229.

5909* Carbide Inserts Give Copy Turning Economy. Shows how maximum economy can be obtained using cutting tools with carbide inserts. Cutting speed must be that which gives most economical tool life. ***B. Almen.*** *Metalworking Production*, v. 104, no. 3, Jan. 20, 1960, p. 95-98.

5910* Performance and Wear Characteristics of Ceramic Tools. Milling with ceramic tools at high cutting speeds shows greater tool life on cast Fe, and on certain nonferrous materials, such as pure Ni. Steels such as AISI 4340 and AISI 1018 have been successfully milled with ceramic tools at 2000 fpm, yielding good tool life with no major evidence of serious chipping under good laboratory controlled conditions. ***E. J. Krabacher.*** *Microtecnic* (English Edition), v. 13, no. 6, Dec. 1959, p. 291-297.

5911 Trends in Gear Cutting and Finishing Processes. ***A. Sykes.*** Paper from "Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958", The Institute of Mechanical Engineers, London. 1958, p. 180-187. (TJ184 In8p Over.)

5912 Developments on Gear Grinding Machines. Current methods of gear grinding and precutting of blanks by means of protuberance tools. Data on the fatigue strength of hardened and ground gears. Methods of grinding tip and root relief and crowning corrections on Maag machines; design features of the correction device. Principles of applying tooth corrections on highly loaded gears. ***L. Martinaglia.*** Paper from "Proceedings of the International Conference on Gearing, London: 23rd-25th September 1958", The Institute of Mechanical Engineers, London. 1958, p. 232-237. (TJ184 In8p Over.)

5913 Cryogenic Sizing. Describes process providing close tolerances at low cost for complex PH stainless parts. It's done at −20 to −100 F, depending on the result desired. The key is to constrain parts through the pliable phase occurring during heat treatment. ***C. H. Jung.*** *Product Engineering*, v. 31, no. 7, Feb. 15, 1960, p. 61-63.

5914* Epoxy Dies for Explosive Forming. Explosive forming makes it possible to shape complex sheet-metal parts in one operation, rather than the series of operations often required for conventional forming. Spectacular cost savings have resulted and these savings can be made even greater by using easily fabricated epoxy dies, which stand up well. ***B. J. Bryan.*** *Tool Engineer*, v. 44, no. 2, Feb. 1960, p. 97-102.

5915* Rolling and Peening Produces Smooth Finishes. Roll-peening with bearingizing tools improves metallurgical properties while producing smooth finishes in holes and on flat concentric surfaces. Describes the process and typical applications and gives reference data to aid in hole surface preparation and sizing. ***Donald Walker.*** *Tool Engineer*, v. 44, no. 2, Feb. 1960, p. 105-109.

5916* Machining Cast Iron With Ceramic Tools. Research carried out in the Netherlands confirms the fact ceramic cutting tools for machining cast iron have considerable advantages over carbide tools. ***J. L. Remmerswaal.*** *Tool Engineer*, v. 44, no. 2, Feb. 1960, p. 115-120.

5917* Tool Engineers Handbook. A Reference Book on All Phases of Planning, Control, Design, Tooling, and Operations in the Manufacturing Industries. Tool design, fabrication, maintenance, and utilization; product design and cost estimating; economical selection of machines, processes, and tools; analysis and improvement of setups and operations; spark machining, electrolytic grinding, surface cleaning by supersonics; and many other comparatively recent topics are covered. ***Frank W. Wilson, editor.*** 2nd Ed. 1959, Sections individually paged. McGraw-Hill, New York. (TJ1125 Am35t2 Ref.)

5918* Definitions and Mathematical Relations of Tube Drawing Processes. Simple mathematical relations are derived and correlated for design and analysis of the tube drawing processes. Shows relationship between the thicknesses of the components of a specified composite tube and the required component-thicknesses of the flatstock from which the tube must be made. ***Anton F. Mohrnheim.*** *Wire*, no. 44, Dec. 1959, p. 161-165.

See also: **5889** (fabrication of Mo and W); **5967** (cemented carbide tools).

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

5919 Segregation in Aluminum-13 Per Cent Uranium Castings. An alloy of Al-13% U was proposed for use as a fuel element material. Purpose of study was to investigate the alloy for possible long-range segregation of U and to observe metallographically the microstructure of several castings. Chemical analysis indicated that castings were relatively homogeneous on a macroscopic scale. An anomalous phase, UAl_3, was observed in the castings which can be accounted for on the basis of solidification theory. ***D. Peckner.*** *ASTM Bulletin*, no. 242, Dec. 1959, p. 51-53.

5920 The Diffusion of Xenon in Silver. Diffusion coefficients for Xe in Ag were determined at temperatures of 500, 600, 700, 735, and 800 C. The activation energy for diffusion is 37·5 kcal/g atom. The diffusion of Xe in Ag is attributed to the mobility of *positive* Xe ions from substitutional sites in the lattice to vacant adjacent sites. ***J. M. Tobin.*** *Acta Metallurgica*, v. 7, Nov. 1959, p. 701-705.

5921 On the Theory of Self-Diffusion in Liquid Metals. The theory of diffusion in liquids was considered from the standpoint of fluctuation theory. It is postulated that diffusion results from the movement of atoms small and variable distances as a result of local density fluctuations. The theory, if correct, also implies that thermodynamic properties such as the partial molar heat of solution are important in solute diffusion and may be more important than solute atomic size effects. ***R. A. Swalin.*** *Acta Metallurgica*, v. 7, Nov. 1959, p. 736-740.

5922 The Role of Vacancies in an Unusual Anelastic Phenomenon. An interpretation of the internal friction results obtained by Entwistle from a variety of quenched Al-rich age-hardening alloys. Although unable to explain his findings, Entwistle concluded that vacancies do not play a direct part in the anelastic relaxation process that he observed in these alloys after prolonged aging near room temperature. The present interpretation, on the other hand, rationalizes much of the experimental information on the basis that the relaxation centers responsible for this phenomenon consist of clusters of solute atoms containing vacant lattice sites. ***B. E. Berry.*** *Acta Metallurgica*, v. 7, Nov. 1959, p. 741-745.

5923 Lattice Parameter and Resistivity Study of Order in the Alloy $CuAu_3$. Observed changes in lattice parameter and resistivity with degree of order indicate $T_c \simeq 190$C for the alloy $CuAu_3$; from Cowley's theory of order this yields $V_1 = 269k$, $V_2 = -26.9k$, $V_3 = 0$, for the ordering interaction energies of pairs of atoms separated by the three shortest distances. The possibility of a linear relationship between lattice parameter and short-range order parameter or configurational energy is examined. ***P. Wright and K. F. Goddard.*** *Acta Metallurgica*, v. 7, Dec. 1959, p. 757-761.

5924 The Lattice Spacings and the Stability of Close-Packed Hexagonal Cu-Ga, Cu-Ge and Ag-Al Alloys. The lattice spacings of close-packed hexagonal ζ-phases in the systems Cu-Ge, Cu-Ga, and Ag-Al were determined as a function of composition and electron: atom ratio, using alloys quenched from 550 C. The results show that overlap of occupied states across the $\{1010\}$ faces of the Brillouin zone occurs at the electron: atom ratio of 1.415 in Cu-Ge alloys, 1.43 in Cu-Ga alloys, and at 1.47 in Ag-Al alloys. In all three systems, the relative distortion of the a lattice spacings due to overlap increases linearly at higher values of overlap at a rate of 3.5×10^{-3} Å per 0.1 increase in the electron: atom ratio. ***T. B. Massalski and B. Cockayne.*** *Acta Metallurgica*, v. 7, Dec. 1959, p. 762-768.

5925 Lattice Parameters and Zone Overlap in Solid Solutions of Lead in Magnesium. Lattice parameters were measured as a function of composition for solid solutions of Pb in Mg with a relative precision of 1:25,000. Both parameters vary smoothly with composition, with no sign of a break or rapid change in slope, and thus give no evidence of any onset of electron overlap across faces of the Brillouin zone, contrary to the results of Raynor. Further consideration of the various lattice parameter data in the literature for five other dilute solid solutions in Mg suggests that in none of these particular solid solutions do the lattice parameter data give satisfactory evidence of the onset of overlap. ***C. B. Walker and M. Marezio.*** *Acta Metallurgica*, v. 7, Dec. 1959, p. 769-773.

5926 Reaction Rate and Growth Forms of Reaction Product in the System Ag-H_2S. The growth form of the reaction product was found to exert a decisive influence on the kinetics of the reaction. ***H. Fischmeister and J. Drott.*** *Acta Metallurgica*, v. 7, Dec. 1959, p. 777-781.

5927 The Effect of Plastic Deformation on the Diffusion of Hydrogen in Nickel. No significant change of the diffusion coefficient was observed for deformations up to 10%. These results are in agreement with a recent theoretical analysis of interstitial diffusion in strained systems based upon considerations of interatomic forces and strain gradients. ***H. H. Grimes.*** *Acta Metallurgica*, v. 7, Dec. 1959, p. 782-786.

5928 The Nucleation of Nickel Whiskers. The nucleation step in the formation of Ni whiskers by H reduction of halide salts was examined. The finding of Gorsuch that whiskers were nucleated on an oxide was confirmed and it was demonstrated that the nucleation step for whisker formation was the H reduction of nickel oxide to metal. ***R. E. Cech.*** *Acta Metallurgica*, v. 7, Dec. 1959, p. 787-792.

5929 On the Theory of Martensitic Transformations. The Generalized Lattice Invariant Shear and the Degeneracy of Solutions for the Cubic to Tetragonal Transformation. The theory of the crystallography of martensitic transformations is extended in terms of generalized elements for the lattice invariant shear. The degeneracy of solutions for the undistorted plane, the orientation relation, and the macroscopic change of shape is examined analytically for the cubic to tetragonal transformation. ***M. S. Wechsler.*** *Acta Metallurgica*, v. 7, Dec. 1959, p. 793-802.

5930 X-Ray Study of the Kinetics of Ordering in AuCu. The transformation occurs by the nucleation and growth of ordered domains in the disordered matrix. The degree of order in the newly formed domains is close to but less than the equilibrium value. ***J. L. O'Brien and G. C. Kuczynski.*** *Acta Metallurgica*, v. 7, Dec. 1959, p. 803-806.

5931* Zinc-Zirconium System. Thermal, metallographic, vapor pressure, and X-ray data were obtained to establish the phase diagram for the Zn-Zr system. Five compounds corresponding to the stoichiometric formulas ZrZn, $ZrZn_2$, $ZrZn_3$, $ZrZn_9$, and $ZrZn_{14}$ were observed. All these compounds, with the exception of $ZrZn_2$, which melts congruently at 1180 C under constrained Zn-vapor conditions, undergo peritectic reactions. The temperature at which the Zn vapor pressure is one atm for a series of alloys was determined from vapor-pressure measurements. The data obtained are summarized in the construction of a one-atm-pressure phase diagram and a phase diagram corresponding to a pressure of less than 10 atm. ***P. Chiotti and G. R. Kilp.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 892-898.

5932* Microstructural Study of the Response of a Complex Superalloy to Heat Treatment. The response of Inconel "700" to heat treatment was studied by light and electron microscopy combined with X-ray and electron diffraction techniques. A heat treatment which results in low ductility for this alloy appears to be associated with the formation of M_6C carbide in a Widmanstätten distribution. This type of precipitation can be suppressed by suitable heat treatment with concurrent increase in ductility. Various other phases precipitated in this alloy are also identified. ***J. R. Mihalisin and J. S. Iwanski.*** *American Society of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 912-916.

5933* The Crystal Structure of $MoNi_3$. This structure is an isotope with that of ordered $TiCu_3$. If the orthorhombic distortion (slight relative to the corresponding orthohexagonal unit cell) is disregarded, the structure may be described in terms of a close-packed ordered atomic layer, stacked in the sequence: abab. The structures of ordered $TiCu_3$ and $TiAl_3$ are homotectic. ***Shozo Saito and Paul A. Beck.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 938-941.

5934* Influence of Tin and Aluminum on the Transition Behavior of Oxygenated Titanium. Metallographic evidence indicates that progressive amounts of O restrict deformation at low temperatures resulting eventually in brittle fracture. The presence of Sn or Al is thought to alter the atomic distribution of O within the Ti lattice in such a manner as to facilitate some degree of slip and twinning. ***E. H. Rennhack and J. F. Libsch.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 942-946.

5935* Subgrain Growth and Softening in Rolled Aluminum Crystals. The isothermal kinetics (at 200 to 400 C) of subgrain growth and of softening were studied in a 99.997% pure Al crystal rolled to 80% R_A, under conditions where recrystallization did not take place. It was found that the kinetics of subgrain growth and of softening were similar, and that the correlation between subgrain growth and softening was in first approximation independent of the annealing temperature. ***Paul A. Beck, B. G. Ricketts, and A. Kelly.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 949-954.

5936* The Solubility of Cementite in Austenite. Reports measurements of the solubility of cementite in austenite at 927 and 1011 C, using a method based on the equilibration of Fe with boro-cementites. ***R. P. Smith.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 954-957.

5937* High-Temperature Aging Structures in γ'-Hardened Austenitic Alloys. Variations in the secondary phase reactions of six Ni- and Co-base alloys were determined as a function of solutioning from 1700 to 2200 F and aging at 1200 to 1800 F for times up to 1000 hr. Room-temperature impact energies and hardnesses were also measured. Precipitation hardening of these alloys results mainly from the grain-interior formation of γ'; $M_{23}C_6$ appears principally as grain-boundary cells which can be eliminated by intermediate high-temperature aging treatments. ***W. C. Hagel and H. J. Beattie, Jr.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 967-976.

5938* Close-Packed Ordered Structures in Binary AB_3 Alloys of Transition Elements. Three new $TiNi_3$-type phases $ZrPd_3$, $HfPd_3$, and $HfPt_3$ were found. In addition, twelve new Cu_3Au-type phases $TiRh_3$, $TiIr_3$, $ZrRh_3$, $ZrIr_3$, $HfRh_3$, $HfIr_3$, VRh_3, VIr_3, $CbRh_3$, $CbIr_3$, $TaRh_3$, and $TaIr_3$ were also found. The lattice contraction for all three structures considered increases with increasing relative size of the A atom, suggesting that it is mostly the A atom that contracts. It was noted that, for the same radius ratio the lattice contraction is larger when the A atom is Ti than if it is Cb or Ta. ***Austin E. Dwight and Paul A. Beck.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 976-979.

5939* Phase Relations and Precipitation in Cobalt-Titanium Alloys. A new constitutional diagram is presented for the Co-rich end of the Co-Ti system. The modifications result from the presence of a new, intermediate, fcc phase, γ, the existence and homogeneity limits of which were established by metallographic and X-ray studies of alloys containing from about 3 tp 30 per cent Ti. The precipitation of the γ phase from supersaturated solid solution was studied by hardness and electrical resistivity measurements, and two distinct stages in the process were observed. ***R. W. Fountain and W. D. Forgeng.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 6, Dec. 1959, p. 998-1008.

5940* Boundary Migration of High-Purity Lead During Creep and Grain Growth. Mean boundary migration depended linearly upon creep extension under various conditions. Prolonged annealing or air-casting increased the proportion of immobile boundaries at a given stage of tests. Grain growth during annealing followed a power law. The linking of migration and sliding in creep and models for migration are examined; activation energies are calculated from these models. Segregation of O to boundaries appears to be a controlling factor. ***R. C. Gifkins.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 6, Dec. 1959, p. 1015-1022.

5941* Aging of Nickel Base Aluminum Alloys. It is shown that Ni_3Al precipitates homogeneously from Ni-rich Al alloys as plates on the (100) planes. Prior to actual precipitation, a process occurs which is believed to be one of increasing short-range order. After precipitating, the Ni_3Al plates enlarge through competitive growth. Discontinuous precipitation can occur simultaneously with the above processes. ***Robin O. Williams.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 6, Dec. 1959, p. 1026-1032.

5942* Precipitation Phenomena in Cobalt-Tantalum Alloys. The property changes were found to depend on (1) general precipitation and (2) lamellar precipitation. Two new intermetallic phases have been identified: (1) α Co_3Ta, a metastable ordered face-centered-cubic compound, and (2) a stable β Co_3Ta phase of hexagonal structure. In addition, the previously reported Co_2Ta phase was found to exist in two allotropic modifications: the hexagonal $MgZn_2$-type and the cubic $MgCu_2$-type Laves phases. ***M. Korchynsky and R. W. Fountain.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 6, Dec. 1959, p. 1033-1043.

5943* Grain Growth in Silicon Iron. Isothermal salt bath annealing of 0.014-in.-thick 3% Si-Fe sheet was conducted at temperatures ranging from 927 to 1260 C in order to investigate the grain growth behavior. Within the temperature range studied normal grain growth did not take place; instead, nucleated grain growth prevailed. The nucleation frequency was found to increase with the annealing temperature, with corresponding decrease in grain diameter of ultimate secondaries after long-time annealing. Grain growth and texture development at various annealing temperatures can be described by families of sigmoidal curves with the time axis. ***P. K. Koh.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 6, Dec. 1959, p. 1043-1048.

5944* A Study of the Solidification Process of Magnesium-Treated Iron. An investigation was made to determine when and how the graphite spheroids were formed during the solidification of Fe-C and Fe-C-Si alloys treated with Mg. ***G. Ohira and K. Ikawa.*** *British Foundryman,* v. 53, Jan. 1960, p. 23-30.

5945 Diffusion of Cerium and Zirconium in Molten Uranium. Coefficients for the diffusion of Ce in molten U were measured over the temperature range 1170-1480 C. An estimate of the coefficient of diffusion for Zr in U at 1270 C is $(1.9 \pm 9.9) \times 10^{-4}$ cm^2/sec. Discusses experimental errors involved in measuring diffusion coefficients at high temperatures. ***Tennyson Smith.*** *Electrochemical Society, Journal,* v. 106, Dec. 1959, p. 1046-1051.

5946 Diffusion of Oxygen in Hafnium. Studies of the diffusion of O in Zr; determines that the diffusion coefficient of O in Hf is smaller by a factor of about ten, although activation energies are the same. ***J. Paul Pemsler.*** *Electrochemical Society, Journal,* v. 106, Dec. 1959, p. 1067-1068.

5947 A Study of the Kinetics of Crystallization of Copper From Liquid Bismuth Solutions. The rates of crystallization of Cu from supersaturated solution in liquid Bi have been studied over a range of crystallization temperatures and degrees of supersaturation. The rates can be fitted to an equation of the form predicted by the dislocation theory of crystal growth. ***D. H. Kerridge.*** *Institute of Metals, Journal,* v. 88, pt. 2; *Institute of Metals, Bulletin,* v. 5, pt. 2, Oct. 1959, p. 74-80.

5948 The Ageing Characteristics of Aluminium Alloys; Electron-Microscope Studies of Alloys Based on the Aluminium-Zinc-Magnesium System. ***G. Thomas and J. Nutting.*** *Institute of Metals, Journal,* v. 88, pt. 2; *Institute of Metals, Bulletin,* v. 5, pt. 2, Oct. 1959, p. 81-90.

5949 A Note on the Uranium-Boron Alloy System. The solid solubility of B in U is low. UB_2, melting at 2385 C, forms a eutectic with U at 2-3 at.–% B. A constitutional diagram is presented. ***B. W. Howlett.*** *Institute of Metals, Journal,* v. 88, pt. 2; *Institute of Metals, Bulletin,* v. 5, pt. 2, Oct. 1959, p. 91-92.

5950* Effects of Cold Working on Precipitation in Age-Hardenable Alloys. Examination of the effects of cold working on the rate of precipitation in high-purity Cu alloys and Al alloys with measurements of electrical resistance, microhardness and thermoelectromotive force, X-ray Laue photographs and small angle scatter method. The correlation between cold working and the excess vacancies retained in quenching was investigated in water-quenched and air-cooled specimens. ***Yōtarō Murakami and Osamu Kawano.*** *Kyoto University, Memoirs of the Faculty of Engineering,* v. 21, pt. 4, Oct. 1959, p. 393-423.

5951 The Preparation of Lead Cable Sheath Materials for Microscopical Metallography. Gives details of techniques developed for the mounting, grinding, polishing and etching of such materials. Quality of the results achieved is indicated in a series of photomicrographs. ***P. Gregory, A. J. Bangay and R. Paris.*** *Metallurgia,* v. 60, Nov. 1959, p. 233-236.

5952* Inclusion Identification in Magnesium Alloy Castings. Three types of inclusions found in EZ33A and ZH62A Mg alloy castings were examined by radiographic, metallographic, X-ray diffraction, and spectrographic techniques. Results showed that the inclusions of the first type were caused by entrained sand grains, those of the second type by Fe-Zr compounds and those of the third type by Al-Zr compounds. ***B. Lagowski and W. A. Pollard.*** *Modern Castings,* v. 37, Jan. 1960, p. 7-12.

5953* Microstructural Changes Upon Tempering Nickel Chromium White Iron at 400 F. A tempering treatment at 400 F is usually applied to martensitic irons and steels used for abrasion-resistant castings. Such a tempering treatment alters the appearance of the martensite plates under polarized light. Electron micrographs show a precipitate within the tempered martensite plates and an electron diffraction analysis of the precipitate discloses that it is ϵ carbide. ***J. R. Mihalisin and R. D. Schelleng.*** *Modern Castings,* v. 37, Jan. 1960, p. 32-35.

5954 Sub-Structure in Single Crystals of Tungsten. Subgrain structures in which the orientation of a crystal changes by less than about 3° in passing over a boundary were observed, delineated by etch pits, in worked and annealed W, and in large single crystals produced by electron bombardment zone melting. These structures can be revealed by several etchants over a limited range of surface orientation. The formation of these structures around hardness impressions and in bent single crystals after annealing is described. The boundaries of these subgrains in worked and annealed W tend to line up on traces of (111) planes as would be expected if these were tilt boundaries formed by polygonization. ***G. A. Geach and F. O. Jones.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 77-88. (TN695 P69p)

5955 On the Recovery and Recrystallization of Tungsten. Vacancy and interstitial elimination as implied by electrical resistance measurements appears to begin at about 400 C. Dislocation migration is probably responsible for the recovery of mechanical properties detectable above 500 C and for the onset of brittleness above 700 C. Recrystallization *in situ* becomes apparent in X-ray diffraction photograms for W annealed above 800 C and can be followed metallographically above about 1300 C. ***J. W. Pugh.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 97-107. (TN695 P69p)

5956 The System Rhenium-Silicon. Three compounds exist in the system, all with melting points below 2000 C. ReSi and $ReSi_2$, with the B20 and C11 structures, respectively,

were confirmed. ReSi forms peritectically from $ReSi_2$ and the melt. The third compound, detected between Re and ReSi has been tentatively assigned the T 1 (Cr Si_3) structure. The addition of 1 wt % C does not stabilize a $D8_8$ form in the Rh-Si system. ***A. G. Knapton.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 412-418. (TN695 P69p)

5957* Iridium Platinum Alloys. A Critical Review of Their Constitution and Properties. ***A. S. Darling.*** *Platinum Metals Review*, v. 4, no. 1, Jan. 1960, p. 18-26.

5958 Precipitation Processes in Steels. Papers presented at Sheffield University, Department of Metallurgy. Topics are (1) precipitation in ferritic steels, (2) precipitation in austenitic steels, (3) intergranular fracture in steels, (4) precipitation during creep. 322 pp. 1959. The Iron and Steel Institute, London. (TN601 I6s Vis.)

5959 The Structure of Metals. A Modern Conception. Lectures delivered at the Institution of Metallurgists Refresher Course, 1958. A review of some of the modern theories of metal structure. Subjects covered include "The Electron Structure of Metals"; "Experimental Aspects of the Electron Theory of Metals"; "Dislocations in Metals"; "Seeing Dislocations". 118 pp. 1959. Interscience Publishers Inc., New York. (TN690 In7s C.3)

See also: **5862** (recrystallization of Al); **5868** (quenched-in vacancies in Al); **5874** (preferred orientation in 4340 steel).

METALS—POWDER

5960 On the Sintering of W-Ni-Cu Heavy Metal. Theory and mechanics of the sintering process; dilatation measurements; properties of sintered specimens. ***Simo Mäkipirtti.*** *Acta Polytechnica Scandinavica, Chemistry Including Metallurgy Series No.* 5, 1959, 71 pp. (T1 Ac81c Vis.)

5961 Tungsten Carbide. Preparation; powder metallurgy; testing and control; cemented-carbide tool manufacture; outlook. ***Albert S. Hester, A. D. Mitchell, and R. W. Rees, editors.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 94-100.

5962* Hot Pressing Powders in England. Techniques for hot pressing Be and cermet powders. High pressures and temperatures are both necessary, and steel sheathing is often needed for larger parts. ***Alan Blainey.*** *Metal Progress*, v. 77, no. 1, Jan. 1960, p. 104-108.

5963 A New Viewpoint on Sintering. Geometric limitations, imposed by irregularity in the shape and size of powder particles and by their random packing, are avoided by describing the sintering body in terms of the topological genus of its surfaces. The genus is found to be equal to one more than the difference between the number of inter-particle contacts and the number of particles, and is subject to experimental determination. The maximum number of cavities that could develop in an unbounded sintering mass is equal to its genus. The mechanisms of material transport (vapor phase, surface diffusion, volume diffusion, and creep) are seen each to have distinct functions to perform in the over-all geometric change that constitutes sintering, densification being effected mainly by creep. ***F. N. Rhines.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 38-54. (TN695 P69p)

5964 The Production of Ductile Tantalum. After a short description of the two standard methods of preparing Ta powders and of the properties of these powders, the sintering is discussed in detail. Two processes—densification, and removal of O, C, N, H, and other impurities—take place concurrently. Information is given on the volatilization temperature ranges for the different impurities. ***G. L. Miller.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959. p. 303-312. (TN695 P69p)

5965 Slip Casting—A New Method in Powder Metallurgy. The difference in sintering of loose, undeformed powders, as used in slip casting, and of pressure-compacted, deformed powder particles is described. Slip casting is analyzed for the new variables of the process, the correlation between the variables, and their effect on the properties of the sintered part. The report also gives details on the plaster-of-Paris molds which are used for forming metals by slip casting. ***H. Hausner.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 419-437. (TN695 P69p)

5966 Fine Particle Strengthening for High Temperature Use. Dispersions of ultra-fine particles of a second phase, which have a very low solubility in the matrix even at elevated temperatures, have been found to be advantageous in metals such as Al, Mg, Cu, Ni, Mo, and W. While the dispersion lowers the ductility of the matrix, the room-temperature tensile strength and especially the stress-rupture properties at elevated temperatures are increased. Secondary recrystallization and grain growth phenomena can be greatly retarded by the proper dispersion. Results are discussed which were obtained in the Ni-Al system by means of two completely different techniques, namely blending of the constituent powders and internal oxidation. ***W. M. Schwarzkopf and N. J. Grant.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 454-465. (TN695 P69p)

5967 Current Status of Cemented Carbide Technology. Gives current status, including fabrication, properties, and utilization, in order to provide a basis for the selection and classification of these materials. ***William O. Woods.*** *U. S. Office of Technical Services, PB* 151302, June 1958, 37 pp. (T21 Un3r Contin.)

See also: **5242** (determination of Co in hard metals).

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

5968 Precipitation Effects in Liquid Aluminium Alloys. Experiments With a Pulsed Ultrasonic Technique. Experiments show that an ultrasonic technique can be used to investigate the presence of oxides and precipitated phases in melts of Al alloys. The precipitation at lower furnace temperatures of intermetallic compounds of Ti and Zr and the entrainment with them of "oxide skins", is demonstrated to be responsible for faults in castings made from the melts. The work has resulted in the development of a modified melting technique, giving better-quality melts for casting. ***N. D. G. Mountford and R. Calvert.*** *Institute of Metals, Journal*, v. 88, pt. 3, Nov. 1959, p. 121-127.

5969* Nondestructive Testing in a Steel Mill. A nondestructive method for testing steel products must be fast, cheap, automatic and, above all, discriminatory. Three unique devices, a seam depth indicator, a tube tester, and a portable ultrasonic unit, are described. ***W. A. Black.*** *Metal Progress*, v. 77, no. 2, Feb. 1960, p. 104-108.

5970 An Investigation on the Flash Testing of Tungsten Wire. A method of assessing the quality of W wire is described. The theory of flash testing is developed and the optimum conditions for the operation of the test are given. Typical photographs of flash-tested wire exhibiting hot spots are included, and behavior of these nonuniformities and their effect on wire performance is discussed. ***D. A. Davies.*** Paper from "Plansee Proceedings, 1958", Metallwerk Plansee AG, Reutte/Tyrol, Springer-Verlag, Vienna. 1959, p. 69-76. (TN695 P69p)

5971* Ultrasonic Testing of Welds. Equipment and procedures. ***R. Hornung.*** *Sulzer Technical Review*, v. 41, no. 1, 1959, p. 81-86.

5972 Automation in Quality Control Testing of Electron Tubes. Describes a test set that operates automatically by being programmed. The set records static and dynamic tests in digital form, stores the data, punches them in tape, and

provides a printed copy of the data. The punched tape is then fed to a computer which analyzes the data for statistical information such as lot means, standard deviations, percentage deltas, and provides the information in printed form. ***Roy A. McNaughton.*** *Sylvania Technologist*, v. 13, no. 1, Jan. 1960, p. 11-15.

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

5973 Manned Nuclear Space Systems. II. Low-Thrust Nuclear Systems. In part I the high-thrust nuclear system is discussed in the performance of the Martian mission, while part II also includes a review comparison of the high- and low-thrust systems. ***R. F. Trapp, M. W. Hunter, and E. B. Konecci.*** *Aero/Space Engineering*, v. 19, Feb. 1960, p. 49-54.

5974* Transactions of the American Nuclear Society 1959 Annual Meeting, Gatlinburg, Tennessee, June 15-17, 1959. A supplement to *Nuclear Science and Engineering*. ***J. G. Beckerley, editor.*** *American Nuclear Society, Transactions*, v. 2, no. 1, June 1959, 256 pp.

5975* Transactions of the American Nuclear Society 1959 Winter Meeting, Washington, D. C., November 4-6, 1959. A supplement to *Nuclear Science and Engineering*. *American Nuclear Society, Transactions*, v. 2, no. 2, Nov. 1959, 238 pp.

5976 The Application of Ultra-High Vacuum Techniques to Controlled Thermonuclear Devices. Gives a discussion of the role played by impurities in the operation of controlled thermonuclear devices, and description of ultrahigh vacuum techniques as applied to experimental stellarator devices. The results of these efforts are described in terms of machine operation before and after achieving U.H.V. Discusses future prospects. ***D. J. Grove.*** Paper from "American Vacuum Society, Inc. 1958, Vacuum Symposium Transactions", Pergamon Press, New York. 1959, p. 9-17. (QC166 C73v Over.)

5977 Vacuum System for the Cambridge Electron Accelerator. Special problems such as eddy currents, small pumping aperture and radiation damage were encountered in the design of the vacuum system for the 6 BeV electron accelerator now being built as a joint effort of Massachusetts Institute of Technology and Harvard University. Proposed solutions to these problems and the result of measurements on model vacuum chambers and pumping systems are discussed. ***Roger L. Hall.*** Paper from "American Vacuum Society, Inc., 1958, Vacuum Symposium Transactions," Pergamon Press, New York. 1959, p. 41-43. (QC166 C73v Over.)

5978 An Introduction to Radiation Counters and Detectors. An historical review is given. The atom structure, radiation detectors, Geiger-Müller tubes, other types of detector based on ion collection, methods of detection not based on ion collection and dosimetry are discussed. ***C. C. H. Washtell.*** 115 pp. 1960, Philosophical Library Inc., New York. (QC 787.C6 W27r)

5979 An Introduction to Thermonuclear Research. A Series of Lectures Given in 1955. The potentialities of a fusion reactor, basic conditions required, some properties of a uniform magnetic field, the problem of the ends, the stellarator, mirror machines and high-energy injection, pinch devices, stability, diffusion across a magnetic field are discussed. ***Albert Simon.*** 182 pp. 1959. Pergamon Press, New York. (QC791 Si53i)

5980 Annual Review of Nuclear Science. *Emilio Segrè and Leonard I. Schiff, editors.* v. IX. 625 pp. 1959. Annual Reviews, Palo Alto, Calif. (QC780 An78 Vis.)

5981 Chemistry of Nuclear Power. Gives a highly authoritative and informative account of the vital part played by chemists in the over-all program of the development of nuclear power. ***J. K. Dawson and G. Long.*** 208 pp. 1959. Philosophical Library, New York. (TK9350 D32s)

5982* Preliminary Results About a Source of Monochromatic Photons, Produced by Annihilation of Positons. A method of production of monochromatic photons by way of annihilation of relativistic positons, obtained from a bundle of electrons, passing through a linear accelerator, is described. *(In French.)* Résultats préliminarires sur une source de photons monochromatiques produits par annihilation en vol de positons. ***Jacques Miller, Claude Schuhl, Gabriel Tamas, and Christophe Tzara.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 249, no. 23, Dec. 9, 1959, p. 2543-2545.

5983* Encyclopedia of Physics. v. XXXVIII. Neutrons and Related Gamma Ray Problems. Introduction to the problem of neutrons, reactions with emission of neutrons and neutron sources, the slowing down of neutrons of energy larger than a few ev, slowing down and diffusion of neutrons in the chemical region, i.e., E less than or of the order of 1 ev, the diffusion of thermal neutrons, penetration and diffusion of X-rays are discussed. ***S. Flügge, editor.*** 868 pp. 1959. Springer-Verlag, Berlin, Western Germany. (QC21 G27h3 Ref.)

5984 Fallout From Nuclear Weapons Tests. v. I, II, III. Hearings before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on Fallout from Nuclear Weapons Tests, May 5, 6, 7, and 8, 1959. 2618 pp. 1959. United States Government Printing Office, Washington. (UF767 U3.21f)

5985 Incinerator for Radioactive Residue. A batch-type incinerator was built to dry and to burn 12 liters of wet, packed rags or the equivalent in other organic matter in eight hours. The material is ignited and burned in a stream of O. Tars in the off-gas are trapped in a water bubbler, residual contaminated particles are caught by an ultrafilter, and acid vapors are reacted in a caustic scrubber. The unit was designed to process Pu residues; other radioactive materials could be handled by the use of appropriate shielding and manipulators. ***W. D. McNeese and W. J. Maraman.*** *Industrial and Engineering Chemistry*, v. 52, Feb. 1960, p. 79A-81A.

5986 Two Group Theory for Criticality Calculations in Asymmetrically Reflected Reactors. Contains an elementary extension to previous treatments, as regards two dimensional bare slab reactors, when there is not a plane of symmetry in the whole of the multiplying and nonmultiplying regions. In the first part, the analytical formulae are derived and in the second and third parts, the sheets are given for criticality and flux calculations. ***S. Albertoni and C. Tamagnini.*** *Italy, Comitato Nazionale per le Ricerche Nucleari, CNI*-5, Nov. 1958, 45 pp. (QC770 Itl.2ci Contin.)

5987 Activation Cross Sections of Er^{162} and Er^{164}. The thermal neutron activation cross-section of Er^{162} and Er^{164} was evaluated by using an isotopic mixture enriched in Er^{162} and Er^{164}. ***G. Segre.*** *Italy, Comitato Nazionale per le Ricerche Nucleari, CNI*-6, Jan. 1959, 7 pp. (QC770 Itl.2ci Contin.)

5988 Alpha-Pulse Analysis by Ionization Chamber. ***G. Bertolini, A. M. Del Turco, and G. Restelli.*** *Italy, Comitato Nazionale per le Ricerche Nucleari, CNI*-10, Apr. 1959, 10 pp. (QC770 Itl.2ci Contin.)

5989 Standardisation of Alpha and Beta Emitters by 4pi Counter. I. The Counter. ***G. Bertolini and O. Terracini.*** *Italy, Comitato Nazionale per le Ricerche Nucleari, CNI*-15, June 1959, 13 pp. (QC770 Itl.2ci Contin.)

5990 On the Elimination of the Barycentric and Rotational Coordinates in a Nuclear "Shell-Model". The possibility of eliminating the barycentric and rotational coordinates is shown in a modified shell-model, and some of its consequences are discussed. ***Bengt R. Holmberg.*** *Kungliga Tekniska Högskolans Handlingar*, no. 145, 1959, 27 pp. (T4 K96t Vis.)

5991* Calculation of the Mesoatomic State Contribution to the Non-Physical Region of the Meson-Nucleon Dispersion Relations. The corrections to the forward dispersion relations for pion-nucleon scattering due to the II mesoatomic intermediate state are considered. The calculations were performed approximately in the frame of the static theory of

pion-nucleon interaction. These corrections were shown to diminish the divergence between the experimental and theoretical data for the energy near to the resonance only by 4 per cent. *(In Russian.)* O vychislenii vklada mezoatomnogo sostoianiia v "nefizicheskuiu" oblast' dispersionnykh sootnoshenii dlia rasseianiia mezonov na nuklonakh. ***Iu. P. Shcherbin.*** *Leningrad. Universitet. Vestnik*, v. 14, no. 22, 1959, p. 64-69.

5992 Men and Atoms. The discovery, uses, and future of atomic energy. ***William L. Laurence.*** 302 pp. 1959. Simon and Schuster, New York. (UF767 L37m)

5993 Metals for Nuclear Reactors. Physical principles, typical design and materials problems, effects of radiation, corrosion by liquid metals and aqueous solutions, fabricating techniques for reactor components and testing methods are discussed. ***W. A. Maxwell, editor.*** 117 pp. 1959. American Society for Metals, Cleveland. (TK9202 M45m)

5994 Nuclear Electronics. II. Reactor control, equipment for prospection and protection, centralization and exploitation of results, transistorized equipment, standardization, and components are discussed. 378 pp. 1959. International Atomic Energy Agency, Kärntner Ring, Wien I, Austria. (QC786 EL25)

5995 A Study of the Feasibility of a Tracer System for Locating a Fuel-Element Failure in a Pressurized Water Reactor. Results indicated that a system of tracer elements for location of fuel-element failure merited further development. The proposed method consists in adding very small amounts, in most cases less than 0.1 w/o, of different pairs of elements to the fuel alloy of each subassembly. These elements become activated during operation of the reactor and produce radioisotopes. When a fuel-element failure occurs, a portion of the coolant is analyzed radiochemically for the elements added to the fuel as tracers. The radioactive species of the elements that are detected indicate the subassembly in which the failure has occurred. The elements which were found to be suitable tracers were Er, Ga, Ho, Ir, Os, Pt, Rh, Sc, Tb, Tm, and Yb. Radiochemical separation procedures were developed for these elements and checked on irradiated alloy specimens. ***Meyer Pobereskin, Duane N. Sunderman, Aaron Eldridge, George D. Calkins, and Walston Chubb.*** Paper from "Nuclear Engineering—Part VI", v. LV, p. 137-147. 1959. American Institute of Chemical Engineers, New York. (QC776 Am35n)

5996 Nuclear Engineering. VII. Radiochemical research in the U.S.S.R., the use of tracer atoms in the physicochemical study of some inorganic polycompounds, effect of gamma radiation intensity on the polymerization of ethylene, blast effects tests of a one-quarter-scale model of the air force nuclear engineering test reactor, heavy-water reactors for power production and other problems are discussed. ***Sylvia Fourdrinier, editor.*** v. LV. 141 pp. 1959. American Institute of Chemical Engineers, New York. (QC776 Am35n)

5997 Nuclear Fuel Elements. Fuels for reactors of the future, solid fuel elements, engineering of fuel elements, fabrication techniques for various types of fuel elements, U and U alloy fuel elements, uranium-zirconium hydride fuel elements, Th-type fuel elements. Pu fuel elements and other problems are discussed. ***Henry H. Hausner and James F. Schumar, editors.*** 409 pp. 1959. Reinhold Publishing Corp., New York. (TK9360 H29n)

5998 Release of Fission Products From Fueled Graphite. Irradiation experiments were performed on fueled graphite to study fission-product release at high temperatures. Very large fission-gas release was observed in elements irradiated or annealed at temperatures in the range of 1000 to 1700 F. However, certain modifications to the fueled graphite were found to result in large reductions in fission-product release. ***W. C. Riley, D. N. Sunderman, and B. W. Dunnington.*** Paper from "Nuclear Metallurgy. v. VI. A Symposium on Effects of Irradiation on Fuel and Fuel Elements", American Institute of Mining, Metallurgical and Petroleum Engineers, New York. 1959, p. 87-94. (TN697 Am35n6)

5999 Nuclear Ship Propulsion. ***Holmes F. Crouch.*** 347 pp. 1960. Cornell Maritime Press, Cambridge, Maryland. (VM312 C88n)

6000 Rapid Assessment of Neutron Activation. A quick and simple method for computing how much activity or how great a specific activity is produced by an exposure to thermal neutrons. The method is based on an approximation of a true buildup curve by its two straight-line asymptotes and a graphical assessment of the error introduced by the approximation. ***Russell B. Mesler.*** *Nucleonics*, v. 18, Jan. 1960, p. 73-75.

6001 Chalk River Experience With Fuel Waterlogging. If it is accepted that fuel defects are likely, then we must find criteria that will minimize the hazards of waterlogging without impairing the facility with which minor fuel defects can be identified and located. ***A. J. Mooradian, G. M. Allison, and J. F. Palmer.*** *Nucleonics*, v. 18, Jan. 1960, p. 81-85.

6002 HTGR—Underlying Principles and Design. Highly dispersed fuel in an all-graphite core and continuous fission-product removal are among the advanced design features that will help the HTGR produce 1400 F He at high-power densities. ***P. Fortescue, D. Nicoll, C. Rickard, and D. Rose.*** *Nucleonics*, v. 18, Jan. 1960, p. 86-90.

6003 Coolant Block Damages SRE Fuel. A leak of organic material from an auxiliary cooling system into SRE's primary loop has subjected the SRE fuel to a much more severe trial than anyone had bargained for. With the flow partially blocked in several channels by deposition of the material, temperatures got high enough to cause the stainless-steel clad to alloy with the U-metal fuel and, finally, to separate near the bottom end. ***Robert W. Dickinson.*** *Nucleonics*, v. 18, Jan. 1960, p. 107 + 3 pages.

6004 Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Thermonuclear reactions in a system with magnetic stoppers, the problem of direct transformation of thermonuclear energy into electrical energy, some problems of the spatial stability of a ring current in a plasma, multi-quantum recombination in an ionized gas, the Boltzmann equation for rarefied gases in strong field, kinetics of an ionized gas in a strong magnetic field, radiative heat transfer from a dense high-temperature plasma and other problems are discussed. ***M. A. Leontovich, editor.*** v. III. 422 pp. 1959. Pergamon Press, New York. (QC786 Ak13.1ftr)

6005 Progress in Nuclear Physics. Includes sections on: the bubble chamber, resonance fluorescence in nuclei, spallation, optical model for nuclear scattering, measurement of helicity, and weak interactions. ***O. R. Frisch, editor.*** v. VII. 326 pp. 1959. Pergamon Press, New York. (QC776 P94 Vis.)

6006 Reaction Kinetics and Unit Operations. Reaction rates in chemical engineering science, transport processes with chemical reaction, turbulent transport in chemical reactors, intraparticle diffusion in catalytic systems, stability of chemical reactors, chemical reactions-system dynamics and other problems are discussed. ***C. H. Barkelew, et al.*** 227 pp. 1959. American Institute of Chemical Engineers, New York. (QD73 Am35r)

6007* Reactor Kinetics. A Bibliography. ***M. Bloomfield and F. G. Bennett, IV.*** 52 pp. Nov. 1, 1959. Office of Technical Services, Dept. of Commerce, Washington 25, D. C. (ZTK9202 Un3.1r Ref.)

6008 Russian-English Atomic Dictionary. Physics, Mathematics, Nuclear Science and Technology. A special dictionary for the English-speaking scientists, researchers, engineers, students, editors, and professional translators in the field covered, with 23,000 Russian entries relative primarily to nuclear science and technology, physics and mathematics, some chemistry and chemical engineering, metallurgy, γ-ray metallography, peaceful and military uses of atoms, biophysics and radiobiology. ***Eugene A. Carpovich.*** 2nd Rev. Ed. 317 pp. 1959. Technical Dictionaries Co., New York. (QC772 C22r2)

6009* Sandia Corporation Bibliography. Gas-Cooled Reactors. This compilation contains 517 references to the unclassified literature on gas-cooled reactors to May 1959. It includes articles, reports, books, and patents. Reactors cooled by air are included, as well as all types of reactors by function —power reactors, research reactors, design studies, and prototypes. References are indexed by reactor, author, report number, and Geneva Conference Paper number. ***William H. Richardson and Francis Strachwitz.*** 214 pp. Sept. 1959,

Office of Technical Services, Department of Commerce, Washington 25, D. C. (ZTK9203.G2 Un3.1g Ref.)

6010 Cosmic Neutrino Radiation. New and more powerful methods for eliminating background intensity are needed in order to make possible the development of neutrino astronomy into a new far-reaching branch of science. ***Georg Marx and Nora Menyhard.*** *Science*, v. 131, Jan. 29, 1960, p. 299-300.

6011 Breeder Reactors. Reactors that produce more fuel than they consume make it feasible to "burn the rocks", that is, to utilize the vast supply of U and Th contained not in rich ores but in rocks such as granite. ***Alvin M. Weinberg.*** *Scientific American*, v. 202, no. 1, Jan. 1960, p. 82-94.

6012 The Study of Elementary Particles by the Photographic Method. An Account of the Principal Techniques and Discoveries Illustrated by an Atlas of Photomicrographs. History of the method, basic technical features of nuclear emulsions, methods of measurement, identification of charged particles, electrons and γ-rays, mesons, heavy or K-mesons, hyperons and hypernuclei, antiprotons, and other problems are discussed. ***C. F. Powell, P. H. Fowler, and D. H. Perkins.*** 669 pp. 1959. Pergamon Press, New York. (QC721 P87s Over.)

6013 IBM 704 Program Report, Aircraft Nuclear Propulsion Shielding Program 09-0. Shielding program 09-0 calculates the fast neutron dose rate due to single-scattered radiation in a homogeneous, infinite medium from an anisotropic point source at any specified, unshielded point detector. The fast-neutron-source energy spectrum may be approximated by 10 energy levels. Exponential attenuation may be considered on either leg as desired. The dose rate from the source spectrum is obtained by summation of the dose rates computed for each initial energy. ***J. W. Haffner, J. J. Loechler, and J. E. MacDonald.*** *U. S. Atomic Energy Commission, APEX-533*, Dec. 1958, 32 pp. (UF767 Un3.1ap Contin.)

6014 Nuclear Safety in Manufacturing Plants. To assure that nuclear safety is established and maintained, three basic problems must be solved satisfactorily. Solution of the scientific problem involves theoretical and experimental knowledge of the various criticality parameters. The second, or engineering problem, requires that the proposed process be analyzed in detail in the light of the scientific information. Finally, administrative controls are necessary to minimize either personnel or equipment failure. ***James E. McLaughlin.*** *U. S. Atomic Energy Commission, HASL-66*, Nov. 3, 1959, 23 pp. (UF767 Un3.1ha Contin.)

6015 Transient Bubble Growth in a Homogeneous Reactor. A mechanism for shutting off a power excursion in a homogeneous reactor is the rapid formation of bubbles; presents results of a study of a model of bubble growth in such reactors. Equations are derived which give upper and lower bounds for the radius of a bubble, as a function of time, under conditions present in an actual reactor. Should make possible the deduction of the growth rate of bubble nuclei from observations of void volume and pressure. ***H. P. Flatt.*** *U. S. Atomic Energy Commission, NAA-SR-3923*, Jan. 15, 1960, 29 pp. (UF767 Un3.1na Contin.)

6016 Improved Alpha Spectroscopy Using a Modified Frisch Grid Ionization Chamber and a 256-Channel Analyzer. Adaptation of a Frisch Grid alpha ionization chamber and its preamplifier to an Argonne-type 256-channel pulse height analyzer for alpha spectroscopy is described. Over-all resolution of better than 1% is achieved. Circuit modifications to the commercial preamplifier are given, and a procedure for electrodeposition of thin samples is described. ***T. B. Crockett, T. T. McMillan, and J. W. Crowe.*** *U. S. Atomic Energy Commission, NAA-SR-4433*, Jan. 1, 1960, 18 pp. (UF767 Un3.1na Contin.)

6017 Coupled Diaphragm Safety Device for Power Reactors. Laboratory experiments were performed in the development of a coupled diaphragm trigger for a power reactor safety device. The coupled diaphragm trigger is a neutron flux sensor which, at excessive flux levels, will trip the safety device and cause reactor shutdown. ***L. E. Johnson.*** *U. S. Atomic Energy Commission, NAA-SR-4434*, Jan. 15, 1960, 28 pp. (UF767 Un3.1na Contin.)

6018 An Extension of Small Source Theory to Include Epithermal Fission. The application of small source theory to thermal reactors as reported by W. A. Horning is here modified to include the effects of epithermal fission. The effects of epithermal fission are found to be (1) to increase the effective number of neutrons produced per thermal neutron absorbed in the fuel and (2) to decrease the probability of a neutron escaping capture during its slowing down period. ***J. W. Zink.*** *U. S. Atomic Energy Commission, NAA-SR-4457*, Jan. 15, 1960, 9 pp. (UF767 Un3.1na Contin.)

6019 Neutron Physics Division Annual Progress Report for Period Ending September 1, 1959. *U. S. Atomic Energy Commission, ORNL-2842*, 244 pp. (UF767 U3o Contin.)

6020 Studies of the Spherical Harmonics Method in Neutron Transport Theory. III. Distribution of the Roots of the Characteristic Equation in the Case of Anisotropic Scattering. ***Walter Kofink.*** *U. S. Atomic Energy Commission, ORNL-2850*, 34 pp. (UF767 U3o Contin.)

6021 Aircraft Nuclear Propulsion Program. Hearings before the Subcommittee on Research and Development of the Joint Committee on Atomic Energy, Congress of the United States 86th Congress, 1st session on the Aircraft Nuclear Propulsion Program, July 23, 1959. 418 pp. 1959. U. S. Government Printing Office, Washington. (TL704.1 Un3.21ah)

6022* Processing and Localization of Radioactive Waste of Nuclear Reactors. As the permissible exposure of the human being to radiation has been established at 0.3 rem (roentgen equivalent man) per week, it must be ensured that this figure, resulting from external radiation and incorporation of isotopes, is exceeded at no point. The most difficult problem arises in the reprocessing of spent fuel elements in isotopes and waste that can still be put to use. The smallest possible activity in waste gases and waste liquors and constantly controlled localization of the waste in enclosed containers, in the Arctic Circle or in desert regions, appear to be the most suitable courses to adopt. *(In German.)* Verarbeiten und Ablagern radioaktiver Abfälle von Kernreaktoren. ***W. Pohlit and B. Rajewski.*** *VDI Zeitschrift*, v. 101, no. 36, Dec. 21, 1959, p. 1751-1767.

See also: **5156** (nuclear chemistry); **5718** (nuclear marine propulsion); **6139** (radioactive waste disposal).

OPERATIONS RESEARCH

6023 "Human Factors"—Newest Engineering Discipline. The rapid technological advances of the last 20 years have generated problems concerning man-machine compatibility that call for an exhaustive knowledge of human behavior. Human engineering tries to analyze the human as a component in a complex system. The effort ranges from "knob and dial" work to developing complex mathematical models of human behavior. ***Christopher Celent.*** *Electronic Industries*, v. 19, Feb. 1960, p. 86-100.

6024* Measurement and Misrepresentation. The possibility of measuring does not necessarily lead to the presentation of relevant information for decision-making in business. This is demonstrated by reference to accounting methods and to profit computation in particular. ***R. J. Chambers.*** *Management Science*, v. 6, no. 2, Jan. 1960, p. 141-148.

6025* The Weapon Systems Management Concept and Electronic Data Processing. Concerns the lack of significant progress in the application of electronic computers for expanding the scope of systems of information flow. The weapon systems management concept, and more particularly its civilian counterpart the product mission concept, is presented as a possible frame of reference for top management and systems analysts to use in long-range planning. ***Jim Rosenzweig.*** *Management Science*, v. 6, no. 2, Jan. 1960, p. 149-164.

6026* Control as an Organizational Process. An attempt to discover to what extent the theory of self-regulating systems applies to human organizations. Feedbacks of information on

performance and objectives were found to have much influence on two types of executive decision processes: programing of routine work and innovation in the organization of executive functions. ***Chadwick J. Haberstroh.*** *Management Science*, v. 6, no. 2, Jan. 1960, p. 165-171.

6027* A Machine-Job Scheduling Model. Avoids the usual in-process inventories and thereby has fewer equations. ***George B. Dantzig.*** *Management Science*, v. 6, no. 2, Jan. 1960, p. 191-196.

6028 A Survey of Operational Research in British Industry. *B. H. P. Rivett.* *Operational Research Quarterly*, v. 10, no. 4, Dec. 1959, p. 189-205.

6029 Some Aspects of a Control and Communication System. Describes the behavior, under stress, of a control unit with this function. The symptoms of distress, the diagnosis and the measures prescribed to prevent complete breakdown and create reserve capacity are discussed. ***A. M. Lee.*** *Operational Research Quarterly*, v. 10, no. 4, Dec. 1959, p. 206-216.

6030 Economic Batch-Size Determination for Multi-Product Scheduling. Suggests a method for determining the economic batch-sizes when it is desirable to maximize the rate of return per unit time for a multi-product schedule. ***Samuel Eilon.*** *Operational Research Quarterly*, v. 10, no. 4, Dec. 1959, p. 217-227.

6031 Business Games in Business. Considers the general form of business game and excludes specialized models developed for a particular industry or group. ***H. R. Watkins.*** *Operational Research Quarterly*, v. 10, no. 4, Dec. 1959, p. 228-244.

6032 A Queueing Model for Spare Coal Faces. Determining the best provision of spar coal faces to allow for unexpected closures of faces can be considered as a problem in queueing theory. A machine-interference type of model is examined with random input, exponential service time and a fixed maximum number of spares. ***F. J. Toft and H. Boothroyd.*** *Operational Research Quarterly*, v. 10, no. 4, Dec. 1959, p. 245-251.

6033 Economically Optimum Sweepdown Criterion for Chemical Processing. Construction of periodic material balances is fundamental to chemical processing. In the light of such balances the processor must decide whether to continue processing or sweep down the plant. ***F. H. Tingey.*** *U. S. Atomic Energy Commission, IDO*-14498, Nov. 30, 1959, 21 pp. (UF767 Un3.1id Contin.)

6034 Value Engineering, 1959. EIA Conference on Value Engineering University of Pennsylvania October 6 and 7, 1959. Collection of papers on the most recent applications of value engineering or value analysis. 165 pp. 1959. Engineering Publishers, Elizabeth, N. J. (TA183 E125v)

ORE AND MATERIALS BENEFICIATION

6035 Survey of the Primary Zinc Industry in Canada in 1958. Mining, milling, and metallurgy. Production by province and company. ***D. B. Fraser.*** *Canada, Mines Branch, Mineral Information Bulletin MR* 32, Aug. 1959, 69 pp. (TN26 C16.55m Contin.)

6036 Corrosion of Mild Steel and Stainless Steel Type 316L in Concentrated Sulphate-Carbonate-Bicarbonate-Chloride Solutions Approaching Those Used in Grinding and Leaching Uranium Ore. *I. I. Tingley and R. R. Rogers.* *Canadian Mining and Metallurgical Bulletin*, v. 53, no. 573, Jan. 1960, p. 18-23; *Canadian Institute of Mining and Metallurgy, Transactions*, v. 63, 1960, p. 16-21.

6037 New: Making Iron in a Fluidized Bed. Flowsheet with explanation of the process. ***R. A. Labine.*** *Chemical Engineering*, v. 67, Feb. 8, 1960, p. 96-99.

6038 Handling and Treatment of Iron Ores. Meetings were held in Amsterdam on April 14-17, 1959, with the members as guests of the Royal Netherlands Blast Furnaces and Steelworks Ltd. Papers presented covered the world iron-ore situation, various ore-handling facilities, and ore treatment methods. Special Report No. 63. 128 pp. 1959. The Iron and Steel Institute, London. (TN601 I6s Vis.)

6039 A New Method of Matte Refining by Pressure Leaching and Hydrogen Reduction. *R. F. Pearce, J. P. Warner, and V. N. Mackiw.* *Journal of Metals*, v. 12, Jan. 1960, p. 28-32.

6040* Separation of Zirconium & Hafnium Using Anion-Exchange Resins. III. Resolution of Hafnia Concentrates. *K. S. Rajan and J. Gupta.* *Journal of Scientific & Industrial Research*, v. 18B, Nov. 1959, p. 460-463.

6041* Interfacial Behavior of Powdered Solid Substances in Liquids. Investigations of Alkali Halides in Organic Liquids With Alkylamines as Surface-Active Additives. Aggregation constants can be obtained from sedimentation curves, whereby they characterize the formation of flake-like aggregates of solid grains in the corresponding liquids. *(In German.)* Über das Grenzflächenverhalten pulverförmiger Festkörper in Flüssigkeiten Untersuchungen an Alkalihalogeniden in organischen Flüssigkeiten mit Alkylaminen als grenzflächenaktiven Zusätzen. ***Edelbert Bischoff.*** *Kolloid-Zeitschrift*, v. 168, no. 1, Jan. 1960, p. 8-23.

6042* Mineral Dressing. Trend toward larger grinding mills continues, several iron-ore beneficiation projects started, development of Canadian iron reserves progresses, base metals continue efforts to improve efficiency, new treatment schemes cited, effort to improve iron ore pelletizing processes intensified. ***E. C. Herkenhoff.*** *Mining Congress Journal*, v. 46, Feb. 1960, p. 45-49.

6043* Rare Germanium Mineral—Renierite Recovered by Magnetic Upgrading. *L. Steygers.* *Mining World*, v. 22, no. 1, Jan. 1960, p. 34-35.

6044* Three Way Separation . . . of Copper, Lead, and Zinc in Complex Ore at Idarado's Mill. Depress Zn and Fe; make bulk Cu-Pb flotation concentrate; clean and re-clean Cu-Pb concentrate; depress Cu and take it off Pb-Cu separation cells as a tailing from eighth cell; clean and re-clean Pb float to produce a Pb concentrate; condition Cu-Pb concentrate tailing for Zn; and float Zn from Cu-Pb concentrate tailing to make Zn concentrate. *Mining World*, v. 22, no. 2, Feb. 1960, p. 30-33.

6045* New Iron-Ore Dressing Plants Taken Into Operation at La Ferrere-Aux-Etangs Mine (Western Coalfield). Black-band ore is subjected to decarbonization by roasting before further treatment. Roasting furnaces must be charged with a graded and sized ore. Screening difficulties result from continual variation of the characteristics of the ore depending on its proportion of limonite, which makes it sticky and which varies with its source of supply. Describes screening and storage plant. *(In French.)* Mise en service de nouvelles installations de preparation mecanique de minerai de fer a la mine de la Ferriere-aux-Etangs Bassin de l'ouest. ***R. Lucas and P. Sauvage.*** *Revue de l'Industrie Minérale*, v. 41, no. 11, Nov. 1959, p. 975-984.

6046* Pilot Plant for Pelletizing Iron Ore Concentrates. Results, obtained in operation of the pilot plant built at the Nizhniy-Tagil Metallurgical Combine for production of the fluxed pellets from the finely-ground Fe ore concentrates, indicated the possibility and expediency of engineering and testing the commercial plant for the same purpose. *(In Russian.)* Opytno-promyshlennaya ustanovka dlya polucheniya okatyshei. ***S. V. Bazilevich, S. V. Makaev, and I. M. Rabinovich.*** *Stal*, v. 19, no. 12, Dec. 1959, p. 1059-1063.

6047* A Method of Separating and Concentrating Cinnabar by Flotation. *Frederick B. Brien and John D. Siddle.* *Trend in Engineering (University of Washington)*, v. 12, no. 1, Jan. 1960, p. 16-20.

6048* Changes in the Concentration of Flotation Reagents in a Pond for Flotation Tailings. In the Spring-Summer period the process of natural disintegration of the flotation reagents in a pond for flotation tailings can be used for the purification of the main flow of the concentration plant. In the Spring-Winter period this process slows down so that

chemical purification methods must be used. *(In Russian.)* Izmenenie kontsentratsii flotoreagentov v khvostokhranilishche. ***L. V. Milovanov, B. P. Krasnov, and N. V. Bidiukova.*** *Tsvetnye Metally*, v. 32, no. 11, Nov. 1959, p. 14-17.

6049* Beneficiation of Nickel Oxide Ores. Flotation and magnetic separation after pyrometallurgical preparation by reducing-sulfurizing annealing with addition of coke dust and pyrite, or by direct reduction by means of coke dust in the presence of phosphorite or NaF can be applied to the beneficiation of nickel oxide ores. The more Fe in the clinker, the lower the Ni content in the concentrate, but the higher its extraction. *(In Russian.)* Obogashchenie okislennykh nikelevykh rud. ***G. A. Khan and A. I. Zarakhani.*** *Tsvetnye Metally*, v. 32, no. 11, Nov. 1959, p. 18-25.

See also: **5640** (coal dressing).

PHYSICS

6050 The Measurement of Conductivity in Semiconductors With the Aid of Microwaves. Method is applicable to thin, disc-shaped samples of substances having a conductivity between 0,1 ··· 200 [ohms cm]$^{-1}$. The procedure is based on Drude-Zener's theory and on a measuring method reported by Horner. This method presents the advantage that no contacts are required between the sample substance and the measuring equipment, as is the case with the various D. C. methods. In the present instance, a cavity resonator is employed for the determination of the requisite values of measurement. ***Tor Stubb.*** *Acta Polytechnica Scandinavica, Physics Including Nucleonic Series No.* 8, 1959, 14 pp. (T1 Ac81p Vis.)

6051* A New Electrophotographic Procedure by Combined Electret Layers. The results cited on Sketch 3 show that the law of interchangeability for the investigated combined electret layers is not fulfilled. *(In Russian.)* Novyy electrofotograficheskiy process, osyshchestvlyayemyy s pomoshch'yn kombinirovannykh elektretnykh sloev. ***B. M. Golovin, et al.*** *Akademiia Nauk SSSR, Doklady*, v. 129, no. 5, 1959, p. 1008-1011.

6052* A Study of Photoelectric Detection Under Pulse Conditions. Application to the Spectrometry of the Raman Effect. A contribution to the detection of low light fluxes found in the spectral analysis of some radiations produced by means of an auxiliary source such as molecular diffusion (Raman and Raleigh effects) or by luminescence. The advantage of short illuminations, the condensed discharge in Hg burners up to 10 kV, or under 100 kV, its application to the detection of the Raman effect were examined. *(In French.)* Étude de la détection photoélectrique en régime d'impulsion. Application a la spectrométrie de l'effet raman. ***François Valentin.*** *Annales de Physique*, v. 4, ser. 13, nos. 11-12, Nov.-Dec. 1959, p. 1239-1290 + 1 plate.

6053* The Formulation of Constitutive Equations in Continuum Physics. II. Concerned with physical properties of materials which can be described in a rectangular Cartesian coordinate system by the relation between the components at some instant t of a tensor u of order μ on the one hand and the components of v vectors and the displacement gradients on the other, at all times from some fixed initial time up to and including the time t. The components of u are therefore functionals of the v vectors and of the displacement gradients over a time interval preceding t. ***R. S. Rivlin.*** *Archive for Rational Mechanics and Analysis*, v. 4, no. 3, 1960, p. 262-272.

6054* Effect of the Nature of the Wall of a Resonance Acoustic Tube on the Determination of the Velocity of the Sound in Liquids. Investigations have been carried out concerning tubes of wood (pile), of Pb, glass, and Fe. Formulas and calculation results are cited. *(In French.)* Influence de la nature des parois d'un tube résonance acoustigue pour déterminer la vitesse du son dans les liquides. ***Constantin Sălceanu and Mircea Zăgănescu.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 249, no. 23, Dec. 9, 1959, p. 2509-2510.

6055* Production of High Frequency Plasmoids, Stable at the Resonance Frequency of the Plasma. H-F, stable plasmoids with density $n \simeq 10^7$ electrons/cm^3 and temperature T = some 10^5 K were obtained. It was found that n agrees at such a value, that the H-F excitation can sustain the electron resonance of the plasmoid, the pulsation of which is given by $\omega_0 = (\sqrt{4\pi\, n \cdot e^2/m})$. *(In French.)* Production de plasmoïdes de haute fréquence stables à la fréquence de résonance du plasma. ***Richard Geller.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 249, no. 25, Dec. 21, 1959, p. 2749-2751.

6056* A Thermodynamic Treatment of Dilute Superconducting Alloys. The effect of adding small concentrations of an impurity to a superconducting metal is analyzed by thermodynamic methods. Two possible types of variation of the Gibbs free energy with composition are then discussed, utilizing a number of simplifying assumptions. ***R. E. Jones, Jr.*** *IBM Journal of Research and Development*, v. 4, no. 1, Jan. 1960, p. 23-27.

6057* A New Optical Method for Wide Angle Tracking. I. A mirror-prism optical element (prismor) is described, by means of which optical scanning through wide angles can be carried out. Discusses limitations of existing systems, and gives examples in which the advantages of the new system are demonstrated. ***J. N. Whyte.*** *Instrument Practice*, v. 14, Jan. 1960, p. 36-41.

6058* Quadrupole & Forbidden Lines in the L-Emission Spectrum of Bismuth 83. The design and construction of a 40 cm curved crystal transmission spectrograph are described; the spectrograph was used to study the quadrupole and forbidden lines in the L-emission spectrum of bismuth 83. The measurements on the previously known quadrupole and forbidden lines were compared with those of the earlier workers. ***B. G. Gokhale, A. N. Nigam, and K. S. Srivastava.*** *Journal of Scientific & Industrial Research*, v. 18B, Nov. 1959, p. 449-454.

6059* Irreducible Representations of the Space Group of Cuprite Type Crystals. The symmetry of cuprite type crystals is studied by means of the group theory. Irreducible representations of the wave vector groups are constructed for all the lines and points of symmetry in the Brillouin zone. The degeneracies of the one-electron energy bands (neglecting the spin-orbit coupling) are indicated. The compatibility tables for various irreducible representations are computed. Some conclusions about the mutual arrangement of electron energy bands for cuprite (Cu_2O) are derived. *(In Russian.)* Neprivodimye predstavleniia prostranstvennoĭ gruppy kristallov tipa zakisi medi. ***A. G. Zhilich.*** *Leningrad. Universitet. Vestnik*, v. 14, no. 22, 1959, p. 5-18.

6060* A Device for the Observation of Nuclear Quadrupole Resonance by Zeeman-Modulation. Describes a simple device for nuclear quadrupole resonance observation directly on an oscilloscope screen without any phase detector. A superregenerative oscillator and Zeeman-modulation was applied; high sensitiveness and simplicity were achieved in the study of the coupling character in a number of molecular crystals. *(In Russian.)* Pribor dlia nabliudeniia iadernogo kvadrupol'nogo rezonansa s ispol'zovaniem Zeeman-moduliatsii. ***V. S. Grechishkin.*** *Leningrad. Universitet. Vestnik*, v. 14, no. 22, 1959, p. 19-23.

6061 Lamellar Grating Far-Infrared Interferomer. The new variable-groove-depth grating-type interferometer that was used to obtain experimental interferograms and spectra used for short and long wavelengths ($\lambda < 15\ \mu$ to $\lambda > 4$ mm), together with its construction and testing, is described. ***John Strong and G. A. Vanasse.*** *Optical Society of America, Journal*, v. 50, Feb. 1960, p. 113-118.

6062 Penetration Depth of Surface Effects in Molecular Crystals. ***B. J. Alder, J. R. Vaisnys, and G. Jura.*** *Physics and Chemistry of Solids*, v. 11, nos. 3-4, Oct. 1959, p. 182-189.

6063 Spin-Wave Resonance in a Ferromagnetic Metal. ***G. T. Rado and J. R. Weertman.*** *Physics and Chemistry of Solids*, v. 11, nos. 3-4, Oct. 1959, p. 315-333.

6064* A Review of Infrared Developments. Describes the increasing application of infrared to military and industrial technology and gives a brief history of infrared developments.

The physics of emission, detection, and absorption of radiation is surveyed and the theory of detectors reviewed. Methods of noise suppression in infrared systems are investigated, and other system design considerations are discussed, including information theory. ***Barton J. Howell.*** *Sperry Engineering Review*, v. 12, no. 4, Dec. 1959, p. 28-38.

6065* Dark-Field Electronmicroscopy and Its Application. A new method was used for dark-field electronmicroscopy; it was not only possible to obtain both bright-field and dark-field images without changing the position of the specimen, but the lowering of the resolution was more minimized than that of the method hitherto obtained. It was applied in the present study for dark-field electronmicroscopy of vaporization film, thin crystal and bacteria. It was found that dark-field images were very interesting and important concerning electronmicroscopy of various specimens. ***Tadatosi Hibi and Shôichi Takahashi.*** *Tohoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 2, no. 6, Dec. 1959, p. 491-507.

6066* Apparatus for the Controlled Deposition of Optical Film Systems. A vacuum plant is described in which multilayer films of evaporated or sputtered layers can be deposited in sequence on a rotating plane surface. The thickness of the individual films is controlled by measuring their reflectance or transmittance during deposition with a modulated-beam photometer of high sensitivity and stability. ***W. Steckelmacher, J. M. Parisot, L. Holland, and T. Putner.*** *Vacuum*, v. 9, nos. 3-4, July-Sept, 1959, p. 171-185.

6067* Electrical Clean-Up of Gases in Hot Cathode Discharge Tubes. Until it becomes possible to reach a decision on the physical phenomena involved in the electrical clean-up of gases it is probably most convenient to interpret the experimental data in terms of the sorption kinetics which, as we have seen, explain to a great extent the observations if applied judiciously. ***G. Carter.*** *Vacuum*, v. 9, nos. 3-4, July-Sept. 1959, p. 190-200.

See also: **5129** (ferroelectric behavior of BaZr niobiate).

PLASTICS

6068 Control of Thermal History of Polyethylene Test Specimens. Physical properties of solid polyethylene are affected by its thermal history. Data from environmental stress cracking, brittleness temperature, density, and Izod impact tests show that the effect of variations in thermal history can be very large. Effect of a particular change in thermal history will depend on the property and the polyethylene sample being tested. ***A. M. Birks and A. Rudin.*** *ASTM Bulletin*, no. 242, Dec. 1959, p. 63-67.

6069* Polymerization of Dienes and Olefins Under the Influence of Cobalt Oxides and Diethylaluminum Halogenides, and a Study of the Polymer Structure. Polymerization decreases in the order: butadiene > isoprene > 1,3-pentadiene > 2,3-dimethyl-1,3-butadiens. The vitrification temperature of poly-2-3-dimethylbutadiene is −16 C. (*In Russian.*) Polimerizatsiya dienov i olefinov pod vliyaniyem okislov kobal'ta i dietilaluminiy galogenidov i izucheniye struktury polimerov. ***E. I. Tiniakova, et al.*** *Akademiia Nauk SSSR, Doklady*, v. 129, no. 5, 1959, p. 1068-1070.

6070* Polymerization and Copolymerization of Dienes and Olefins on a Chromium Oxide Catalyst. The polymerization of 1,3-pentadienes, and α-butenes and the copolymerization of dienes and olefins are discussed; properties of the polymers and copolymers obtained are described as well as the kinetics of polymerization of butadiene, isoprene, and the copolymerization of an equimolecular mixture of butadiene with isoprene at 80 C in benzene solution. (*In Russian.*) Polimerizatsiia i sopolimerizatsiia dienov i olefinov na khromokisnom katalizatore. ***E. I. Tiniakova, B. A. Dolgoplosk, R. N. Kovalevskaia, and T. G. Zhuravleva.*** *Akademiia Nauk SSR, Doklady*, v. 129, no. 6, Dec. 21, 1959, p. 1306-1308.

6071* The Synthesis of Polyvinylcyclohexane. (*In Russian.*) Sintez poliviniltsiklogeksana. ***A. V. Topchiev, E. A. Mushina, A. I. Perel'man, and B. A. Krentsel.*** *Akademiia Nauk SSSR, Doklady*, v. 130, no. 2, Jan. 11, 1960, p. 344-345.

6072 Fusion of Polymer Networks Formed From Linear Polyethylene: Effect of Intermolecular Order. Melting points and specific volume-temperature behavior of linear polyethylene samples which have been crosslinked both above and below the melting point temperature are studied as functions of radiation dose and irradiation temperature. ***L. Mandelkern, D. E. Roberts, J. C. Halpin, and F. P. Price.*** *American Chemical Society, Journal*, v. 82, Jan. 5, 1960, p. 46-53.

6073 The Kinetics of Ozonization of Polyalkylbenzenes. A spectrophotometric method was employed in studying the kinetics of the reactions of a series of polyalkylbenzenes with ozone in carbon tetrachloride and in acetic acid at 25 C. ***T. W. Nakagawa, L. J. Andrews, and R. M. Keefer.*** *American Chemical Society, Journal*, v. 82, Jan. 20, 1960, p. 269-276.

6074 A General Treatment of Equilibrium Polymerization. Three chemical categories are discussed: equilibrium polymerization in the presence of an initiator, e.g., caprolactam, and two categories that do not involve an initiator, represented by sulfur and by vinyl monomers, respectively. ***A. V. Tobolsky and A. Eisenberg.*** *American Chemical Society, Journal*, v. 82, Jan. 20, 1960, p. 289-293.

6075 Ionic Polymerization. I. Reaction Mechanism Investigation of the Cationic Polymerization of α-Olefins Through Intermediate Carbonium Ion Complexes. ***G. A. Olah, H. W. Quinn, and S. J. Kuhn.*** *American Chemical Society, Journal*, v. 82, Jan. 20. 1960, p. 426-430.

6076* A Revew of Cellular Plastics. A brief review of developments in rubber, phenolic, PVC, polystyrene, polyurethane, polythene, cellulose acetate, and silicone foams. *Applied Plastics*, v. 3, Feb. 1960, p. 20-22.

6077* The Effects of Thermal Environment on Laminated Plastics. The effects of extreme temperature and humidity conditions on characteristics important in electrical and mechanical applications are briefly discussed. ***S. W. Place.*** *Applied Plastics*, v. 3, Feb. 1960, p. 44-46.

6078* Round-Link Chains Made From Glass Fibre Reinforced Plastics. Chain links consist of specially shaped bodies of plastics in which a polyester bonded glass fiber strand is embedded in accordance with a specially developed winding method. Depending on application, the plastics component may consist of polyamide, polythene, or a modified type of PVC. The glass filling accounts for about 60% of the weight. *Applied Plastics*, v. 3, Feb. 1960, p. 47-48.

6079* The Preparation and Polymerization of Mixed Tetraorthoesters of Titanium. The monomeric esters are produced by the reaction of $TiCl_4$ with different alcohols. These esters are then polymerized by partial hydrolysis. ***P. Dunn.*** *Australian Journal of Applied Science*, v. 10, no. 4, Dec. 1959, p. 458-463.

6080* A Xanthene Polymer With Semiconducting Properties. The polymer is composed of condensed xanthene residues cross-linked with phenyl bridges. The polymers are *p*-type semiconductors and the best has a specific resistance of 7×10^3 Ω cm, which is less than that of crystalline organic semiconductors by a factor of at least 10^4. ***R. McNeill and D. E. Weiss.*** *Australian Journal of Chemistry*, v. 12, no. 4, Nov. 1959, p. 643-656.

6081 Anionic Polymerisation of Vinyl Monomers With Butyl-Lithium. The effects of concentration of catalyst, temperature, and solvents on polymerization. ***Max Frankel, Ariel Ottolenghi, Michael Albeck, and Albert Zilkha.*** *Chemical Society, Journal*, 1959, Dec., p. 3858-3864.

6082* Stereospecific Polymerizations of Conjugated Diolefins. V. Preparation and Properties of Isotactic 1,2-Polybutadiene. The polymerization of butadiene using apparently homogeneous catalysts prepared from $Al(C_2H_5)_3$ and various Cr compounds, was studied. Depending on the Al-Cr mole ratio and the time of reaction between the catalyst components, polymerization products are obtained having a crystal-

line fracture of either isotactic or syndiotactic structure, or a mixture of the two. (*In Italian.*) Polimerizzazioni stereospecifiche di diolefine coniugate. V. Preparazione e proprietà del polibutadiene 1,2 isotattico. ***G. Natta, L. Porri, G. Zanini, and A. Palvarini.*** *Chimica e l'Industria*, v. 41, Dec. 1959, p. 1163-1169.

6083 Compression and Transfer Moulding of Plastics. Topics covered are mold design, preheating, and bolster strains and stresses. ***J. Butler.*** 230 pp. 1959. Interscience Publishers, Inc. (TP986.5 B97c)

6084* An Improved Epoxy-Resin System for Electronic Embedments. Use of liquid anhydride curing resins makes possible a compound which can be applied at temperatures up to 200 C as well as at low temperatures. Manufacturing advantages are indicated. Details of formulations and comparative test data are provided. ***B. H. Mueller and C. A. Harper.*** *Electrical Manufacturing*, v. 65, Feb. 1960, p. 119-122.

6085* Polypropylenes—Their Structure and Properties. Several properties of the polypropylenes are compared with other thermoplastics. ***C. A. Finch.*** *Fibres and Plastics*, v. 21, Jan. 1960, p. 14-16.

6086* Polyurethanes—Their Preparation and Applications. ***M. Sircon.*** *Fibres and Plastics*, v. 21, Jan. 1960, p. 22-24.

6087* Testing Butyrate Pipe. Testing methods described include short-time burst, creep tests, impact strength, and a few minor tests for specific applications. ***Roy O. Hill, Jr.*** *Gas*, v. 36, Mar. 1960, p. 91 + 7 pages.

6088 Plastics. A review of the new developments in types and in production methods of plastics. Some commercial plastics are evaluated as to the serious problems in properties and the misuse by producers. The main polymers reviewed were the polypropylene films, the new thermoplastic resin polyoxymethylene, the glass-reinforced polyesters, vinyl plastics, and the fluorocarbons. ***E. L. Kropa and E. E. McSweeney.*** *Industrial and Engineering Chemistry*, v. 52, Jan. 1960, p. 42A-45A.

6089 Polymerizing Vinyl-2-Ethyl Hexoate With Gamma-Rays. ***D. A. Guthrie and J. F. Black.*** *Industrial and Engineering Chemistry*, v. 52, Jan. 1960, p. 51-54.

6090 International Symposium on Plastics Testing and Standardization. A compilation of papers on engineering and thermal properties of plastics, and molecular characterization. Publication No. 247. 269 pp. 1959. American Society for Testing Materials, Philadelphia. (TA455.P7 Am35i)

6091* Retardation of Polymerization in Substituted Styrenes by Chelated Nitrophenols. The importance of temperature effect on inhibitor selection. ***John L. Lang.*** *Journal of Chemical and Engineering Data*, v. 5, no. 1, Jan. 1960, p. 53-56.

6092* Plasticizers From Tetrahydrofurfuryl Alcohol. Properties of tetrahydrofurfuryl alcohol esters are given. ***L. H. Brown and J. W. Hill.*** *Journal of Chemical and Engineering Data*, v. 5, no. 1, Jan. 1960, p. 56-58.

6093* Epoxysiloxane Casting Resins. A Study in Geometry and Functionality. Viscosity, gel time and exotherm with methylene-dianiline, and casting properties of epoxysiloxanes are discussed. ***E. P. Plueddemann.*** *Journal of Chemical and Engineering Data*, v. 5, no. 1, Jan. 1960, p. 59-62.

6094 Inorganic Polymerization Reactions. II. Addition Polymerization. Deals with processes of addition polymerization in which repeating units of the high molecular-weight aggregates are identical with the monomers from which the polymers are derived. Reactions of molecular association through H bonding and of processes in which elemental or molecular species undergo change to products of high molecular weight are reviewed. ***D. B. Sowerby and L. F. Audrieth.*** *Journal of Chemical Education*, v. 37, Feb. 1960, p. 86-91.

6095 Dielectric Properties of Linear Polyamides. The dielectric properties were studied over a range of frequency and temperature. ***David W. McCall and Ernest W. Anderson.*** *Journal of Chemical Physics*, v. 32, Jan. 1960, p. 237-241.

6096* Interfacial Polycondensation. I. II. Fundamentals of Polymer Formation at Liquid Interfaces. III. Polyamides. IV. Polyphthalamides. V. Polyterephthalamides From Short-Chain Aliphatic, Primary, and Secondary Diamines. VI. Polyamides Based on 4,4′-Sulfonyldibenzoic Acid. VII. Polyurethanes. VIII. Application to A—B-Type Monomers. IX. Polysulfonamides. X. Polyphenyl Esters. XI. Ordered Copolymers. General nature of interfacial polycondensation, major variables, and comparison of the principles and laboratory techniques with those pertaining to melt polymerization. I. ***Emerson L. Wittbecker and Paul W. Morgan.*** II. ***Paul W. Morgan and Stephanie L. Kwolek.*** III. ***R. G. Beman, Paul W. Morgan, C. R. Koller, Emerson L. Wittbecker, and E. E. Magat.*** IV. ***Manfred Katz.*** V. ***Victor E. Shashoua and William M. Eareckson, III.*** VI. ***C. W. Stephens.*** VII. ***Emerson L. Wittbecker and Manfred Katz.*** VIII. ***J. R. Schaefgen, F. H. Koontz, and R. F. Tietz.*** IX. ***S. A. Sundet, W. A. Murphey, and S. B. Speck.*** X. ***William M. Eareckson, III.*** XI. ***Donald J. Lyman and S. Lup Jung.*** *Journal of Polymer Science*, v. 40, Nov. 1959, p. 289-418.

6097* The Morphology of Semicrystalline Polymers. I. The Effect of Temperature on the Oxidation of Polyolefins. Oxidation rates of several uninhibited polyolefins were determined in the temperature range 40-140 C. ***W. L. Hawkins, W. Matreyek, and F. H. Winslow.*** *Journal of Polymer Science*, v. 41, Dec. 1959, p. 1-11.

6098* High Pressure Polymerization of Ethylene. A Kinetic Study of Polymerization Initiated by 2,2′-Azobisisobutyronitrile. Ethylene was polymerized at 70-120 C and 100-1500 kg./cm.^{2} pressure. Density of the polymer decreased with temperature, and molecular weight increased with pressure, independent of amount of initiator. ***Shinjiro Kodama, et al.*** *Journal of Polymer Science*, v. 41, Dec. 1959, p. 83-95.

6099* The Thermal Degradation of Poly-*p*-xylylene. The thermal stability of poly-*p*-xylylene prepared in solution by the Hofmann reaction is shown to be more stable thermally and more soluble than polymer prepared from *p*-xylene by the pyrolytic method. The polymer decomposes by a first-order random cleavage mechanism with an activation energy of 58 kcal./mole. ***J. R. Schaefgen.*** *Journal of Polymer Science*, v. 41, Dec. 1959, p. 133-141.

6100* Radiation Graft Copolymerization in Aqueous Dispersion. The γ-radiation-initiated graft polymerization of styrene with rubber is similar to that with methyl methacrylate, though the fraction of grafted polymer is lower. In the photo-initiated systems, styrene behaves differently from methyl methacrylate. The rate of polymerization diminishes at higher monomer concentrations. ***W. Cooper, P. R. Sewell, and G. Vaughan.*** *Journal of Polymer Science*, v. 41, Dec. 1959, p. 167-176.

6101* Thioglycol Polymers. I. Hydrochloric Acid-Catalyzed Autocondensation of Thiodiglycol. II. Phosphorus Pentoxide-Catalyzed Autocondensation of Thiodiglycol and 2,2′-Dihydroxydiethyl Disulfide. III. Copolymerization of Thiodiglycol and Similar Thioglycols With Aliphatic Hydroxy Compounds. I. ***F. N. Woodward.*** II. ***J. T. Abrams, K. J. M. Andrews, and F. N. Woodward.*** III. ***K. J. M. Andrews, R. J. Rosser, and F. N. Woodward.*** *Journal of Polymer Science*, v. 41, Dec. 1959, p. 219-239.

6102* Polymerization of Butene-1 With Ziegler Catalysts. The polymerization was studied in detail by means of the pressure bottle technique. The polymers are generally from 50 to 70% atactic. ***A. I. Medalia, A. Orzechowski, J. A. Trinchera, and J. P. Morley.*** *Journal of Polymer Science*, v. 41, Dec. 1959, p. 241-263.

6103* Soluble Homopolymers and Copolymers From 2,6-Disubstituted-1,6-Heptadienes. The disubstituted heptadienes readily form soluble, high molecular-weight copolymers with vinyl- and acrylate-type monomers if dilute solutions are employed and polymerization it not too rapid. ***G. N. Milford.*** *Journal of Polymer Science*, v. 41, Dec. 1959, p. 295-305.

6104* The Copolymerization Characteristics of Vinylene Carbonate, γ-Crotonolacetone and Methyl Bicyclo(2,2,1)-2-heptane-5-carboxylate. ***Joseph M. Judge and Charlie C.***

Price. *Journal of Polymer Science,* v. 41, Dec. 1959, p. 435-443.

6105* Caprolactam Polymerization. The equilibrium resulting from the water initiated polymerization of caprolactam was investigated. ***Herbert K. Reimschuessel.*** *Journal of Polymer Science,* v. 41, Dec. 1959, p. 457-466.

6106* Allyl Polymerization. V. Effective Chain Transfer in the Polymerization of 3-Buten-2-yl Acetate. Polymerization of 3-Buten-2-ol. ***Norman G. Gaylord and Francis M. Jujawa.*** *Journal of Polymer Science,* v. 41, Dec. 1959, p. 495-506.

6107* Crystalline Vinyl Ether Polymers. By use of modified Ziegler-type catalysts or of a totally different type of highly stereospecific catalyst, highly crystalline, high-molecular weight polymers were prepared from a variety of alkyl vinyl ethers as well as from vinyl ethers containing other functional groups. All the polymers gave sharp x-ray diffraction patterns. ***E. J. Vandenberg, Richard F. Heck, and David S. Breslow.*** *Journal of Polymer Science,* v. 41, Dec. 1959, p. 519-520.

6108* Studies on Dielectric Behavior of High Polymers. The frequency characteristics for PVC, polyvinyl isobutylether, and Nylon 6 were measured over the frequencies from 100 c/s to $2 \cdot 10^6$c/s, at various temperatures. ***Yōichi Ishida.*** *Kolloid-Zeitschrift,* v. 168, no. 1, Jan. 1960, p. 29-36.

6109 New Design Data for FEP TFE. II. Thermal, Wear, and Electrical Properties. FEP and TFE fluorocarbon plastics are suitable for many applications requiring resistance to temperature and corrosion, and good electrical properties. Effects of temperature on expansion, distortion, and elasticity of Teflon plastics are explained. Wear characteristics include hardness, fatigue, impact, and abrasion data. Resistance to arching and high frequencies makes these plastics desirable for electrical insulation. ***L. H. Gillespie, D. O. Saxton, and F. M. Chapman.*** *Machine Design,* v. 32, Feb. 18, 1960, p. 156-162.

6110 New High Temperature Epoxy Resin Good for Exposure to 500 F. Heat and chemical resistance, electrical properties, and potential applications are discussed. *Materials in Design Engineering,* v. 51, Jan. 1960, p. 9-10.

6111 Low Pressure Reinforced Plastics. Discusses the resins and reinforcements, molding methods, and design information available for the reinforced plastics. ***Malcolm W. Riley.*** *Materials in Design Engineering,* v. 51, Feb. 1960, p. 103-118.

6112 Fluorination of Polyethylene. Possible uses of fluorinated polyethylene as a new packaging medium because of chemical and permeability resistance. ***Jules Pinsky, A. Adakonis, and A. R. Nielsen.*** *Modern Packaging,* v. 33, no. 6, Feb. 1960, p. 130 + 3 pages.

6113 The Year 1959 in Review. Review of the plastics industry. Includes 492 references. ***Gordon M. Kline.*** *Modern Plastics,* v. 37, no. 5, Jan. 1960, p. 151 + 10 pages.

6114 The Weathering of High Polymers. Factors responsible for deterioration in normal service of all high polymers are discussed. ***H. J. M. Langshaw.*** *Plastics (London),* v. 25, Jan. 1960, p. 40-45.

6115 Studies on the Strength of Plastics. I. Studies on the mechanical strength of various plastic materials, especially their fatigue strength and creep properties. ***Hiroshi Aida, Yukio Sakae, and Daizo Sunamoto.*** Paper from "Proceedings of the Second Japan Congress on Testing Materials", The Japan Society for Testing Materials, Kyoto, Japan. 1959, p. 192-196.

6116* Chemically Cross-Linked Polyethylene. "Vulkene" is compared to neoprene and polyethylene as to high temperature characteristics, electrical stability, abrasion and impact resistance, and chemical resistance. ***E. R. Kerwin.*** *Rubber and Plastics Age,* v. 40, Dec. 1959, p. 1337 + 3 pages.

6117* Fine Particle Reinforcing Silicas and Silicates in Elastomers. The manufacturing methods, properties of the commercial products, and types of reinforcement are discussed. ***John H. Bachmann, John W. Sellers, Melvin P. Wagner, and Ralph F. Wolf.*** *Rubber Chemistry and Technology,* v. 32, no. 5, Dec. 1959, p. 1286-1391.

6118* High Temperature Elastomeric Compounds and Polymers. Temperature effect and research on high temperature elastomers. ***E. R. Bartholomew, G. Richard Eykamp, and W. E. Gibbs.*** *Rubber Chemistry and Technology,* v. 32, no. 5, Dec. 1959, p. 1587-1626.

6119* Strength of Reinforced Laminates. Strength properties of laminates made from fabric exposed to 30 and 65% relative humidities for one week and one month were found to be unaffected. When humidity was upped to 97%, strength was significantly reduced. The 181 glass fabric with three types of finishes was used—Volan A, 136, and Garan. Paraplex P-43 and Epon 828 with curing agent CL were the resins used. ***B. G. Heebink and Gordon Stevens.*** *SPE Journal,* v. 16, Jan. 1960, p. 39 + 5 pages.

6120* Prediction of Impact Resistance From Tensile Data. Testing of plastics with tensile tests determined at strain rates which correlate with impact resistance tests. ***Robert M. Evans, Harry R. Nara, and Edward G. Bobalek.*** *SPE Journal,* v. 16, Jan. 1960, p. 76-83.

6121* Epoxy Resins for the Encapsulation of Electronic Components. By careful control of materials and regulations of processing conditions, low cost and high reactivity epoxy compounds can be utilized on the production line for encapsulating electronic components. The use of proportioning-metering equipment greatly extends the limits of applications of these compounds. ***Arthur F. Ringwood.*** *SPE Journal,* v. 16, Jan. 1960, p. 93-100.

6122* Polymer Science—Stress Relaxation and Combined Stress Creep of Plastics. II. ***W. N. Findley.*** *SPE Journal,* v. 16, Feb. 1960, p. 192 + 5 pages.

6123* A New Thermoplastic Material. An acrylic-type plastic, designated Baker PL-11, has been developed that can be used satisfactorily at temperatures approaching 250 F. The physical properties obtained, using standard A.S.T.M. methods, are given. ***J. Briskin and C. H. Schramm.*** *SPE Journal,* v. 16, Feb. 1960, p. 209-211.

6124* A Theory for the Stereospecific Polymerization of Propylene Oxide by Ferric Chloride. ***E. J. Corey.*** *Tetrahedron Letters,* 1959, no. 2, Mar., p. 1-6.

6125* Lithium Triethoxyaluminohydride as a Convenient Reagent for the Conversion of Nitriles to Aldehydes. ***Herbert C. Brown, Charles J. Shoaf, and C. P. Garg.*** *Tetrahedron Letters,* 1959, no. 3, Apr., p. 9-10.

6126* Studies on Low-Pressure Polymerization of Ethene. The Interaction of $AlEt_2Cl$ and $TiCl_4$. Polymerization of Ethene at Low Temperature; Formation of Bifunctional Products. ***R. van Helden, A. F. Bickel, and E. C. Kooyman.*** *Tetrahedron Letters,* 1959, no. 12, Sept., p. 18-23.

6127* Preparation of Graft Copolymers. IV. The Grafting of Styrene to Polyamides. V. The Grafting of Vinyl Monomers to Polyethyleneterephthalate. Graft copolymers were obtained from styrene and ozone treated polycaprolactam and anide G-669 films. The possibility of preparing graft polymers from polyethyleneterephthalate and the vinylmonomers: styrene, acrylonitrile, vinylidene chloride, and vinyl acetate were investigated. *(In Russian.)* Poluchenie privitykh sopolimerov. IV. Privivka stirola k polianidam. V. Privivki vinilnlkh monomerov k poliztilentereftalatu. ***V. V. Korshak, K. K. Mozgova, and M. A. Shkolina.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 11, Nov. 1959, p. 1573-1579; 1604-1609.

6128* Degradation of Polyacrylonitrile by the Action of an Ultrasonic Field. The longest polymer chains degrade first; the polymer thus obtains a more uniform molecular weight distribution. *(In Russian.)* Destruktsiia poliakrilonitrila pod deistviem ultrazvuko vogo polia. ***B. E. Geller, G. V. Goryachko, N. A. Dmitrieva, and N. I. Larionov.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 11, Nov. 1959, p. 1610-1616.

6129* Studies in the Mechano-Chemistry of Polymers. VIII. Degradation of Polydimethylsiloxane by the Action of Ultrasonic Waves. The effect on the rate of ultrasonic

degradation of polydimethylsiloxane of the US intensity, concentration of the solutions, type of solvent, and medium was studied. The rate constants of degradation for various US intensities were calculated. *(In Russian.)* Iccledovanie v oblasti mekhano-khimii polimerov. VIII. Destruktsiia polidimetilsiloksana pod deĭstviem ultrazvuka. ***A. A. Berlin and A. M. Dubinskaya.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 11, Nov., 1959, p. 1678-1684.

6130* Synthesis and Investigation of Polyurea. New polyureas were synthesized by the addition of diisocyanates to diamines. Reaction rate is discussed. Some of the polyureas synthesized were shown to be capable of practical application as forming materials, as well as sheets and films with high ultimate strength and dielectric properties. *(In Russian.)* Sintez i issledovanie polimochevin. ***O. Ia Fedotova, et al.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 11, Nov. 1959, p. 1685-1690.

6131* On Vinylcrotonate and Its Polymer. Polymerization in the presence of a radical type of initiator. *(In Russian.)* O vinilkrotonate i ego polimere. ***E. N. Rostovskiĭ and A. N. Barinova.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 11, Nov. 1959, p. 1707-1712.

6132* Polymerization of Some Monomers During Disintegration of Inorganic Substances. *(In Russian.)* Polimerizatsiia nekotorykh monomerov pri dispergirovanii neorganicheskikh veshchestv. ***N. A. Plate, V. V. Prokopenko, and V. A. Kargin.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 11, Nov. 1959, p. 1713-1720.

6133* Infrared Spectroscopic Studies of the Aging of Polyvinylethylal. After heat treatment and ultraviolet irradiation of polyvinylethylal films, a decrease in the number of –C–O–, CH and OH groups and the appearance of C=O and =C–O– groups was noted. *(In Russian.)* Izuchenie stareniia poliviniletilalia pri pomoshchi infrakrasnoi spektroskopii. ***E. V. Shuvalova.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 12, Dec. 1959, p. 1749-1753.

6134* A Study of the Interaction Between Isopropylbenzene Hydroperoxide and Rongalite and the Use of the Reaction to Initiate Polymerization in Acid Media. A study of the mechanism underlying the action of an oxido-reduction system with the participation of rongalite and of the use of the system for initiating polymerization in acid media with the purpose of obtaining carboxylated polymers. *(In Russian.)* Izuchenie reaktsii vzaimodeĭstviia gidroperekisi izopropilbenzola s rongalitom i ee ispolzovanie dlia initsiirovaniia polimerizatsii v kislykh sredakh. ***B. E. Kutsenok, E. I. Tiniakova, and B. A. Dolgoplosk.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 12, Dec. 1959, p. 1830-1839.

6135* The Use of Aluminoorganic Compounds as Catalysts of the Polymerization of 3,3′-*bis*-(Chloromethyl)-oxacyclobutane and Isobutylene. Aluminum ethyldichloride may be used as catalyst in these polymerizations. The cationic catalysts, diethylaluminumchloride and triethylaluminum, cause formation of polymers of 3,3′-*bis*-(chloromethyl)-oxacyclobutane with high intrinsic viscosity. *(In Russian.)* Primenenie aliumniĭorganicheskikh soedineniĭ v kachestve katali zatorov polimerizatsii 3,3′-*bis*-(khlormetil)-oksatsiklobutana i izobutilena. ***B. A. Kropachev, B. A. Dolgoplosk, N. M. Geller, and Ia. M. Rozinder.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 12, Dec. 1959, p. 1844-1847.

6136* Studies on the Spherulite Structure of Polymers. I. Degradation of Polymer Spherulites Under the Action of Fast Electrons. The action of fast electrons on the spherulite structure of polyethylene, polypropylene, and polyethylenesebacate. In the course of irradiation amorphization of the specimens first sets in, followed by degradation of the spherulite structure, causing the disappearance of the Maltese cross. *(In Russian.)* Issledovanie sferolitnoĭ struktury v polimerakh. I. Razrushenie polimernykh sferolitov pod deĭstviem bystrykh elektronov. ***P. V. Kozlov, Li Pan-Tun, and N. F. Bakeev.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 12, Dec. 1959, p. 1848-1852 + 4 plates.

6137* On Some Methods of Synthesis of Graft Polymers. Polyacrylic acid-styrene and polyvinyl alcohol-styrene copolymers have been obtained mechano-chemically with the aid of a newly devised laboratory screw masticator. *(In Russian.)* O nekotorykh sposobakh polucheniia privitykh sopolimerov. ***N. A. Platé, V. P. Shibaev, and V. A. Kargin.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 12, Dec. 1959, p. 1853-1858.

See also: **5345** (vinyl cyclohexene polymerization); **5391** (irradiated Teflon); **5914** (epoxy dies for explosive forming).

POLLUTION AND WASTES

6138* Impounding and Liming Acid Mine Drainage. A new approach proposed is to construct impoundments below sources of acid mine drainage. These impoundments would be filled during periods of high flow and would be treated with lime to maintain an alkaline pH. Experience with lakes in a similar position relative to sources of such drainage indicate that they act to correct the low pH. ***Vernon W. Cole.*** *Industrial Wastes,* v. 5, no. 1, Feb. 1960, p. 10-11.

6139* Problems in Radioactive Wastes Disposal. Presents cost figures and data. ***R. J. Koltzbach.*** *Industrial Wastes,* v. 5, no. 1, Feb. 1960, p. 21-23.

6140* The Areas Within Concentration Isopleths Downwind of Continuous Point Source. Empirical formulae for estimating the area covered by concentrations of gas equal to or exceeding a given value are presented. These formulae are derived from regression lines of the value of the logarithm of the area against the logarithm of the critical concentration divided by the source strength and the logarithm of the concentration divided by the source strength and multiplied by the wind speed at 2 m. ***William P. Elliott.*** *International Journal of Air Pollution,* v. 2, no. 2, Oct. 1959, p. 115-126.

6141* The Longevity of the Phytotoxicant Produced From Gaseous Ozone-Olefin Reactions. The half-life of the phytotoxicant from ozonated 3-heptene is ¼ hr while the phytotoxicant from ozonated 2-pentene has a much shorter half-life. This difference in stability can be explained in terms of the "zwitterion" mechanism. ***Wilfred Niels Arnold.*** *International Journal of Air Pollution,* v. 2, no. 2, Oct. 1959, p. 167-174.

6142* Synthetic Detergents in Well Water. The presence of synthetic detergents, or "syndets," in ground water is being reported with increasing frequency, and the number of incidents may be expected to rise still more as housing developments are constructed in areas not served by either public water supplies or public sewers. ***Jerome Deluty.*** *Public Health Reports,* v. 75, Jan. 1960, p. 75-77.

See also: **5199** (trapping H_2SO_4 mists); **5843** (electrical dust precipitation).

RUBBER AND ELASTOMERS

6143* Compounding Silicone Rubbers. The effects of high molecular weight silicone gums, reinforcing inorganic fillers, organic peroxides, heat aging additives, pigments and plasticizers on rubber properties are discussed. ***J. Ames.*** *Institution of the Rubber Industry, Transactions,* v. 35, no. 6, Dec. 1959, p. 197-209.

6144* High Temperature Tensile Properties of Elastomers Containing Carboxyl Groups. The vulcanization of butadiene elastomers containing carboxyl groups with epoxy resins and metal oxides is described. ***Robert A. Hayes.*** *Journal of Chemical and Engineering Data,* v. 5, no. 1, Jan. 1960, p. 63-65.

6145* The Crystallization of Modified *cis*-Polybutadiene. ***G. S. Trick.*** *Journal of Polymer Science,* v. 41, Dec. 1959, p. 213-217.

6146* The Stereoregular Polymerization of Isoprene With Lithium and Organolithium Compounds. The polymer

has molecular structure, configuration, and physical properties similar to Hevea rubber. ***R. S. Stearns and L. E. Forman.*** *Journal of Polymer Science*, v. 41, Dec. 1959, p. 381-397.

6147* The Influence of Highly Active Silica on the Heat Aging of Sulfurless Latex Vulcanizates Cross-Linked by Thiuram Compounds. *(In German.)* Über den Einfluss hochaktiver Kieselsäure auf die Wärme-Alterung von Schwefelfreien, durch Thiuram-Verbindungen vernetzten Latex-Vulkanisaten. ***Andrasch Andresen.*** *Kautschuk und Gummi*, v. 13, Jan. 1960, p. WT1-WT12.

6148 Thermal Expansion of Elastomers. Synthetic rubber swells and shrinks with changes in temperature. Tests give new design data for seals. ***John Jordan.*** *Machine Design*, v. 32, Jan. 7, 1960, p. 144.

6149 Silicone Rubbers That Cure at Room Temperature. Properties, heat aging, and uses for RTV silicone rubbers. ***C. A. Berridge and R. Treat, Jr.*** *Materials in Design Engineering*, v. 51, Jan. 1960, p. 128.

6150 What's New in Fluorosilicone Rubbers? A discussion of property improvements in the new compounds over the original fluorosilicone rubber. ***R. S. Naegele and T. D. Talcott.*** *Materials in Design Engineering*, v. 51, Feb. 1960, p. 13-15.

6151* Kinetic Studies on the Curing Reaction of Natural and Synthetic Rubbers. Characteristics of the curing reactions involved in the S vulcanization of Perbunan with sulfenamide and dibenzothiazolyl accelerators were examined. *(In French.)* Études cinétiques des réactions de vulcanisation du caoutchouc naturel et des caoutchoucs de synthèse. ***Walter Scheele.*** *Revue Générale du Caoutchouc*, v. 36, Nov. 1959, p. 1695-1707.

6152* Butadiene Polymerization by Lithium. How Li concentration affects the polymerization speed, gel content, and molecular weight was studied. ***C. Ortlieb.*** *Revue Générale due Caoutchouc*, v. 36, Nov. 1959, p. 1708-1710.

6153* Elastomeric Properties of Butyl Rubber. Discusses size, shape, composition, crosslinking, deformation, and degradation. ***D. J. Buckley.*** *Rubber Chemistry and Technology*, v. 32, no. 5, Dec. 1959, p. 1475-1586.

6154* The Preservation and Concentration of Hevea Latex. ***John McGavack.*** *Rubber Chemistry and Technology*, v. 32, no. 5, Dec. 1959, p. 1660-1674.

See also: **5245** (rubber analysis).

SPACE HEATING AND CONDITIONING

6155* Low vs. High Velocity Air Distribution. Both have their uses and drawbacks. Here are some tips on where high velocity systems can be used—and where they can't. ***C. O. Wood.*** *Air Engineering*, v. 2, no. 2, Feb. 1960, p. 24-26.

6156* Better Air for Industry. III. Discusses features and applications of all types of wet and dry collectors for air pollution control in modern industrial processes. ***Richard V. Sloan.*** *Air Engineering*, v. 2, no. 2, Feb. 1960, p. 30-32.

6157* Good Industrial Ventilation Design Pays for Itself. The three installations discussed involve unique applications of proven and acceptable methods. ***James C. Barrett.*** *Air Engineering*, v. 2, no. 2, Feb. 1960, p. 33-36.

6158 Olympic Heat Pump Installation Warms Spectators, Melts Snow. Novel system at Squaw Valley delivers heat removed by ice rink refrigeration system. ***Dan Vandament.*** *Heating, Piping & Air Conditioning*, v. 32, Feb. 1960, p. 99-102.

6159 New Nuclear Center Demands Precise Air Conditioning Systems. Both complex and conventional air conditioning systems are now in use at Combustion Engineering's new $15 million nuclear center. ***D. M. Collins.*** *Heating, Piping & Air Conditioning*, v. 32, Feb. 1960, p. 118-120.

6160 Air Cooled Self-Contained Units Simplify Office Building's Modernization. Milwaukee's 33-year-old Century Bldg. installed air conditioning as the big selling point in its remodeling program. ***Murray Kabili.*** *Heating, Piping & Air Conditioning*, v. 32, Feb. 1960, p. 126-127.

See also: **5149** (glass fabric filters); **5778** (free-piston engine compressor for air-conditioning system).

TEXTILES, FIBERS, LEATHER, AND PAPER

6161* Progress in Charcoal Production. Continuous Residue Carbonization. Sawdust is conveyed by screw feeds through tubes in a chamber maintained at 800-900 F. Sawdust is carbonized in two hours, then sprayed with steam. No supplemental heat is needed after the carbonization is started. ***E. E. Gargan and W. R. Smith.*** *Forest Products Journal*, v. 9, Nov. 1959, p. 395-397.

6162* Kiln Drying Chemically Treated Scarlet Oak and White Oak Lumber. Unseasoned lumber was treated with a chemical seasoning agent and dried rapidly with high-temperature schedules. The schedules used were too severe for scarlet oak, though dry-spread salt did reduce honey-combing. White oak was dried to a moisture content of 8% in 10 days with little degrade. ***A. E. Lund and M. A. Taras.*** *Forest Products Journal*, v. 9, Nov. 1959, p. 398-403.

6163* Indices of Quality . . . Vibrational Properties of Wood. Vibration offers a promising method for nondestructive testing of wood. The characteristics of clear wood can be estimated to an accuracy heretofore considered unattainable. ***B. A. Jayne.*** *Forest Products Journal*, v. 9, Nov. 1959, p. 413-416.

6164* Collapse in Wood . . . Exploratory Experiments in Its Prevention. Collapse and drying defects were reduced markedly under severe drying conditions by replacing water with organic liquids. ***E. L. Ellwood, B. A. Ecklund, and E. Zavarin.*** *Forest Products Journal*, v. 10, Jan. 1960, p. 8-21.

6165* Decay Resistance and Dimensional Stability of Five Modified Woods. Five types of modified wood—wood impregnated with a fiber-penetrating phenolic resin, wood with hydroxyl groups replaced with acetyl groups, thermally modified wood, wood cross-linked with formaldehyde, and wood bulked with polyethylene glycol—showed good dimensional stability and decay resistance. Causes for this resistance: insufficient water can be taken up to support decay, and susceptible hydroxyl groups are removed or blocked so that decay enzymes cannot dissolve wood components. ***A. J. Stamm and R. H. Baechler.*** *Forest Products Journal*, v. 10, Jan. 1960, p. 22-26.

6166* Flame-Spread Measurements by the Radiant Panel Flame-Spread Method. Moisture content, mean density, and surface grain structure of untreated wood affect flame-spread index significantly. Flame-spread indices of fire-retardant-coated assemblies were significantly lower. This method can be used to evaluate fire-retardant coatings for wood-base materials. ***Daniel Gross.*** *Forest Products Journal*, v. 10, Jan. 1960, p. 33-36.

6167* Charcoal Kiln Operation for Improved Timber Stands. Efficient operation of a charcoal kiln makes it economically feasible to do improvement cutting and cull nonmerchantable material to improve the entire stand. A chart gives data on labor costs, charcoal prices, and wood costs so that the break-even point can be calculated. ***C. E. Boldt and Carl Arbogast, Jr.*** *Forest Products Journal*, v. 10, Jan. 1960, p. 42-44.

6168* Means for Reducing the Checking of Douglas-Fir Plywood. Checking of Douglas-fir plywood can be eliminated by stress-relieving the face veneers. Also, checking is more conspicuous in plywood with the tight side out than with the loose side out. ***A. Elmendorf and T. W. Vaughan.*** *Forest Products Journal*, v. 10, Jan. 1960, p. 45-47.

6169* Forestry's Space-Age Future—Flying or Falling? A forecast of the economic future of the forest industries. ***George A. Craig.*** *Journal of Forestry,* v. 58, Feb. 1960, p. 93-98.

6170* Use of Fine Mill Residues in Industry. Finding markets for wood residues is largely a matter of geography (or transportation) plus imagination. To be attractive to the buyer, the residue product must carry a minimum transportation charge. For this reason, the author recommends exploiting local markets. ***J. Allan Hauter.*** *Northeastern Logger,* v. 8, no. 8, Feb. 1960, p. 10 + 4 pages.

6171* Use of Fine Mill Residues in Agriculture. Describes uses of wood wastes from saw mills for mulching and soil amendments, bedding and litter, and suburban gardening supplies. ***E. W. Foss.*** *Northeastern Logger,* v. 8, no. 8, Feb. 1960, p. 12 + 3 pages.

6172* Potential Uses of Bark. ***John M. Sayward.*** *Northeastern Logger,* v. 8, no. 8, Feb. 1960, p. 14 + 5 pages.

6173* Wood and Plastics. A comparative review of some of the physical properties of wood and plastics. ***Menachem Lewin.*** *Research Council of Israel, Bulletin,* v. 7C, no. 2, Dec. 1959, p. 81-112.

6174 Review of Textile Progress. Physics and chemistry of fibrous materials, fiber production, conversion of fibers into finished yarns, fabric production, coloring of textiles, and finishing of textile fabrics. v. X. 494 pp. 1959. Interscience Publishers, Inc., New York. (TS1449 R32 Vis.)

6175* How Much Research? A Critical Problem in the Manufacture of Textile Dyes. ***G. S. J. White.*** *Society of Dyers and Colourists, Journal,* v. 76, Jan. 1960, p. 16-22.

6176* Self-Smoothing Cellulosic Fabrics. Of the large number of new effects which may be obtained by suitable entanglements of the molecular chains of cellulose, the most outstanding are associated with crease-recovery, both wet and dry. These and other properties may be stabilized and made durable through the use of certain chemical compounds such as thermosetting resins (phenol-formaldehyde, urea-formaldehyde, or melamine-formaldehyde), reactant resins (bifunctional derivatives of imidazolidones and triazones), and linear reactants (formaldehyde, butanedioldiurethane, epoxy compounds, and glycols). Self-smoothing fabrics of cotton and rayon require different amounts of reagents for a similar result, but the quantities are almost equal when calculated on the amorphous contents of the fibers. ***J. T. Marsh.*** *Society of Dyers and Colourists, Journal,* v. 76, Jan. 1960, p. 23-37.

6177* Mechanical Properties of Raw Collagen Fibres. ***F. R. Morgan and R. G. Mitton.*** *Society of Leather Trades' Chemists, Journal,* v. 44, Jan. 1960, p. 2-23.

6178* Electrically-Conductive and Static-Free Papers. Organic chemicals have been found which can be used to make paper electrically conductive or to eliminate the static problems widely known in the paper and printing trades. This article briefly reviews the principles of static electrification, and describes the mechanism of action of conductive chemicals and the properties of papers treated with these chemicals. ***Mason Hayek.*** *Tappi,* v. 43, Feb. 1960, p. 105-112.

6179* The Evaluation of Fibers for Insulating Board—A New Approach. ***James d'A. Clark.*** *Tappi,* v. 43, Feb. 1960, p. 139-143.

6180* Distribution of the Constituents Across the Wall of Unbleached Spruce Sulfite Fibers. ***Otto Kallmes.*** *Tappi,* v. 43, Feb. 1960, p. 143-153.

6181* Relationships Between Wood Density and Other Wood and Pulp Properties. It is concluded that specific gravity should be considered a factor in plus-tree selection only to the extent that it influences wood (and pulp) yield. Additional studies may lead to a combining of specific gravity, springwood percentage, pentosans content, and alphacellulose (and possibly other factors such as fiber strength) into a pulp quality term which can be evaluated in judging tree superiority. ***Louis A. Hiett, Walter L. Beers, Jr., and Karsten A. Zachariasen.*** *Tappi,* v. 43, Feb. 1960, p. 169-173.

6182* Water-Repellent Treatment of Textiles With Silicones: Studies on the Mechanism of Gelling-Type Processes. Reactions involving polymethylsiloxane and some metallic salts in the presence of water, proceed by rapid alkaline hydrolysis followed by slow condensation of resultant silanol groups. ***J. A. C. Watt.*** *Textile Institute, Journal, Transactions,* v. 51, Jan. 1960, p. T1-T16.

6183* Shrinkproofing of Wool With Polyglycine From the Polymerization of Thiazolid-2:5-Dione. Shrinkproofing of wool with thiazolid-2:5-dione is not possible from aqueous solution but, can be obtained from a range of organic solvents of low water affinity at temperatures $>40°$. The abrasion resistance of treated fabric is about 1.5-2 times that of untreated fabric, but cost of treatment would be prohibitive in practice. ***J. H. Bradbury and J. D. Leeder.*** *Textile Research Journal,* v. 30, Feb. 1960, p. 118-127.

6184* Location of Areas of Reaction in Chemically Treated Cotton Cellulose. . . . including dyeing, mercerization, acid and enzymatic hydrolysis, derivative formation, and resin impregnation. The appearance of fiber fragments treated in these ways, or derived from treated fibers, is illustrated and discussed. ***V. W. Tripp, A. T. Moore, I. V. de Gruy, and M. L. Rollins.*** *Textile Research Journal,* v. 30, Feb. 1960, p. 140-147.

See also: **5056** (plant physiology).

WELDING AND JOINING

6185 Significance of Surface Preparation in Cold Pressure Welding. Concludes that scratch-brushing is a particularly effective form of surface preparation for cold welding because: (1) It removes surface contaminants and allows welding to be carried out before they have time to be readsorbed. (2) It forms hard rough layers on the two surfaces to be welded which "adhere" to each other during their progress through the roll gap and thereby break up as one so exposing the maximum area of virgin metal for potential bonding. ***L. R. Vaidyanath and D. R. Milner.*** *British Welding Journal,* v. 7, Jan. 1960, p. 1-6.

6186 Dynamic Behaviour of d.c. Generators for Arc Welding. Proposal for a Definition of Suitability for Welding. Oscillographic studies of the behavior of several d.c. welding generators have made it possible to define the "suitability for welding" of a generator in terms of a coefficient r, or less precisely by a coefficient p. These values are practically independent of the skill of the operator and of the type of basic electrode used. The suitability of a generator for welding is considered to be satisfactory if r is greater than 0·6 or p is greater than 0·7. ***A. Carrer.*** *British Welding Journal,* v. 7, Jan. 1960, p. 6-14.

6187 The Effect of Oxygen Additions to the CO_2—Shielded Metal Arc. Investigates the effect of adding excess O to the CO_2 shielding gas in the inert-gas metal-arc process. The burn-off rate and droplet transfer frequency of the process are not affected by the addition of up to 10% O. In larger amounts, up to 100%, the droplet transfer rate is still unaffected but gross porosity occurs, depending on the deoxidizing qualities of the filler wire. ***A. A. Smith.*** *British Welding Journal,* v. 7, Jan. 1960, p. 15-19.

6188 Stresses in Cylindrical Vessels Due to Local Heating Stress Relief of Circumferential Welds. In heating a pipe or vessel locally to a circumferential butt weld, with the object of stress-relieving the weld, there is a danger that the local heating may itself result in the appearance of residual stresses. The present approximate analysis indicates the level of thermal stress to be expected, as a function of the length of pipe heated and the pipe mean radius and thickness. ***R. T. Rose.*** *British Welding Journal,* v. 7, Jan. 1960, p. 19-21.

6189 Some Aspects of Cracking in Welded Cr-Ni Austenitic Steels. A Survey of the Literature. ***J. C. Borland and R. N. Younger.*** *British Welding Journal,* v. 7, Jan. 1960, p. 22-59.

See also: **5418** (film heat seals); **5971** (ultrasonic testing of welds).